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TABLE OF CONTENTS

PRINCIPAL ARTICLES

North America

South America

Europe

Africa

Australasia and Oceania

General

DEPARTMENTS

Separate Illustrations

THE
GEOGRAPHICAL REVIEW

VOL. III JANUARY, 1917 No. 1

SOME EFFECTS OF ENVIRONMENT ON THE FUEGIAN TRIBES

By CHARLES WELLINGTON FURLONG, F.R.G.S.

Today, when the uttermost corners of the earth are being discovered and explored and when, through various applied sciences and inventions, man is more and more regulating his surroundings, the study of environmental influence must claim our attention. Most valuable in the elucidation of its problems are the data obtainable among primitive peoples. With them the response to environment is most simple and direct, and the *technique of existence,* as I define the different ways in which different peoples do the same things, is least varied and complex.

Among the most primitive, most rapidly disappearing and least known of the world's inhabitants are those peoples living in the cold southern antipodes of South America. For the ethnologist and geographer they have an interest correspondingly great. They embrace the tribes living in Fuegia and that part of Patagonia from about 47° S. Fuegia I would define as that region lying south of the Strait of Magellan and terminating in the Diego Ramirez Islands (56° 30′ S.). Patagonia extends from the Strait of Magellan north to the Rio Negro (39° S.).

Fuegia comprises a vast archipelago: its islands are the unsubmerged portions of the Andean chain where it dips into Drake Strait, to reappear on the Antarctic Continent; its channelways are sunken Andean valleys through which swirl and eddy the icy currents of the southern oceans.

Throughout practically the entire year Fuegia feels the cold Antarctic breath of the terriffic southwesterly to northwesterly gales that pound upon its coasts of granite and greenstone. The Antarctic Current eternally chills its shores, and snow, storm, and lowering grayness hang like a grim canopy over its snow-clad mountain peaks. An acquaintance in Punta Arenas told me of a lone missionary to these parts who kept a

meteorological record which showed during the year three hundred days of rain and storm—the other sixty-five not pleasant.[1]

Except where the great combers pound in on certain exposed rock-girt portions of these coasts, the mountain slopes and valleys are clothed with a sylvan and floral growth almost tropical in its luxuriance. Water-soaked bogs underlie the dense forests, which reach tree line at about eighteen hundred feet. The prevailing southwest winds sweeping up from the Antarctic Ocean reach these coasts heavily moisture-laden. Deflected upwards on the western slopes of the Andes, they are cooled, and rapid condensation takes place. Precipitation is almost continuous: on the lower slopes as rain, responsible for the thick forest covering and bog; on the upper slopes and peaks as snow, giving these regions their eternal icy crowns of white and here and there spilling their glaciers into the channelways.

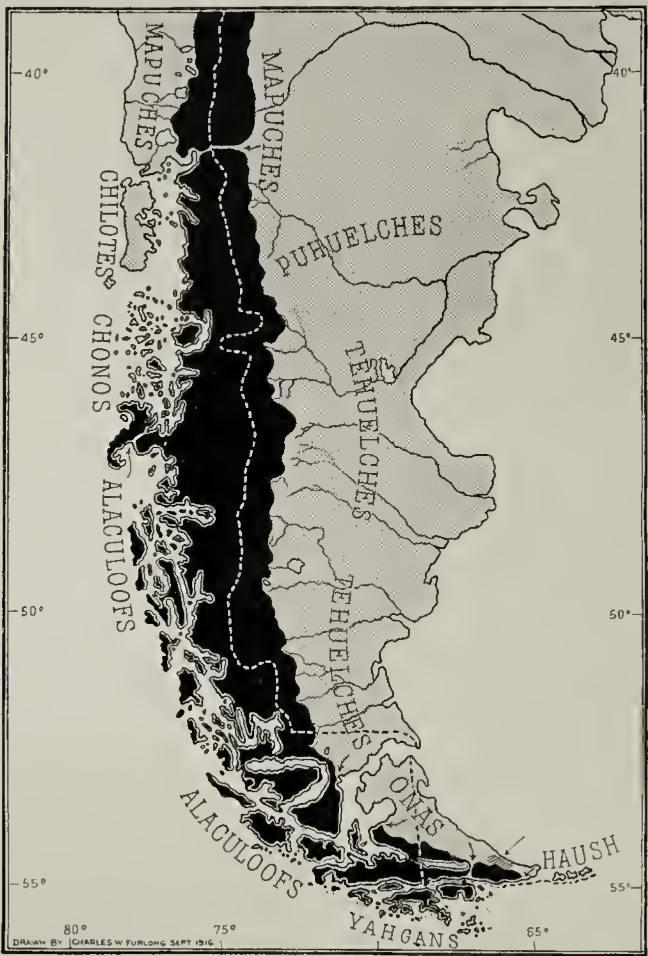

FIG. 1—Map of Patagonia and Tierra del Fuego showing effect of environment on migrations and tribal distribution. Scale, 1:20,000,000.

Gray areas represent occupied territory. Black areas represent the great mountain barriers separating these territories. Arrows indicate passes through this barrier and consequently the possible points of contact between certain of these tribes. Small cross-lined area in the extreme south represents a semi-barrier of difficult traveling country between the Onas and the Haush. The white dotted line represents the present boundary line between Chile and Argentina. It is interesting to note that this line, particularly if we include the Strait of Magellan as an ancient water barrier, today follows almost identically the center of the barrier which formed the boundary between the American tribes.

North of the Strait of Magellan the same relations of wind and topography hold good, but the Andean chain is higher and the region presents more marked climatic contrasts. One may pass from the cold, forested, rain-soaked region of the western slopes to the eastern side of the divide, onto great treeless semi-arid plains, whose barren wastes slope toward the Atlantic. Over these *pampas* rip and tear the *pamperos,* terrific winds dry-sucked of their moisture on the Pacific slopes.

[1] There is, however, much variety in weather. At Ushuaia, where the Argentine government maintains a meteorological station, the average annual rainfall (1896-1907) is only 21.5 ins. (547 mm.). Ushuaia occupies a sheltered position. Staten Island, at the extreme southeast of Tierra del Fuego, has three times as heavy a precipitation.

For Ushuaia the following temperature values, for the period 1904-1907, are extracted from "Climate of the Argentine Republic" by Walter G. Davis, Buenos Aires, 1910: highest monthly mean, 10.0°C; lowest monthly mean, —1.7°C; absolute maximum, 27.0°C; absolute minimum, —20.2°C.

These regions still support remnants of their autochthonous inhabitants. Over the dry, wind-swept plains roam the Patagonians, comprising principally the Puhuelches (northern people) and Tehuelches (southern people). Since the advent of the Spaniard they have become horse people. Through the weird maze of the Patagonian archipelago cruise canoe peoples, in the north the Chonos and Chilotes, in the south the Alaculoofs (also spelled Alaculufs). These last extend into the Fuegian archipelago. In

FIG. 2—Map of southernmost Patagonia, the Strait of Magellan, and Tierra del Fuego, showing tribal distribution. Scale, 1:6,500,000.

The names in the key represent regional designations and are derived from the tribal names. The territory of each tribe is considered to be that frequented by it, even though occupied seldom and by but a few members of the tribe. All blank spaces represent unoccupied territory. Tehuelcha extends north farther than here shown and south to the edge of the strait. Onia extends to the strait on the west and also along Lake Cami. Some Onas have been exiled to Dawson Island. A few have occasionally visited Punta Arenas. Alaculoofa extends up the Patagonian archipelago farther north than shown on this map, and a few families have extended their migrations into Yahgana as far as the vicinity of Murray Narrows. An occasional Yahgan has reached Patagonia. I found one at Lago, Argentina, and two to my knowledge have reached Dampier Island. Others have been taken by missionaries to Keppel Island in the Falklands.

that inconceivable labyrinth dwell the southernmost inhabitants of the world.

On the largest island, Tierra del Fuego, live that splendid tribe of foot people, the Onas, with a remnant of a practically extinct tribe, the Haush (Howsh). In the tortuous channelways and open reaches southward, clear to Cape Horn, live another canoe tribe, the Yahgans (Yäh′ gans). These regions, extending nearly fifteen hundred miles farther south than the Cape of Good Hope, were, I believe, among the last of the earth's habitable portions to be occupied by man.

Whence came these late migrations and why? Ask of these people them-

FIG. 3.

FIG. 4.

FIG. 3. Fragments of the great Andean barrier: A midsummer day on Ponsonby Sound; Packsaddle Island showing dark. An exceptionally calm spell.

selves? You ask in vain. History and tradition they have none. Their prohibition against mention of the dead precludes this, and it is impossible to obtain names or genealogical facts prior to three generations back at best. Although discovered in 1520, not until the nineteenth century was any kind of scientific study of these people begun.

The physical features of the Americas have favored meridional movement. In the southern continent the north-south direction of the Amazon's great tributaries and of the La Plata system, as well as the trend of the vast Andean chain, the channelways of the Patagonian archipelago, and the Argentine pampas mark clear routes for north-south migrations, and in the regions south of 40° S. the movement appears to have been to progressively higher latitudes.

Among the primitive and semi-civilized peoples the weaker tribes or groups are naturally driven from the more desirable lands to those where it is more difficult and hazardous to obtain food. Thus, not infrequently, are they forced to the outermost edges of territories, and on maritime fringes they necessarily become fisher folk. May we not assume that the progenitors of these tribes who occupy the uncompromising southern regions of South America did not by choice leave the more productive lands to their north but were driven south by stronger peoples?

North of Patagonia, beginning at about 41° 30′ on the western slopes of the Andes, the more open, desirable coastal strip of Chile was occupied by a strong, fearless race, the Mapuches (Máh-poo-ches), whose territory extended over the Andean divide by way of the fertile pampas regions of northwestern Patagonia. It is reasonable to suppose that the Mapuches (Araucanians) forced southward a weaker tribe, this in turn pushing farther southward a tribe still weaker, and so on.

These tribes naturally followed the paths of least resistance: the fisher folk in their canoes down the Patagonian channelways, the foot peoples down the Patagonian plains and onto the plains of northern Tierra del Fuego. It is a significant fact that each successive tribe of the canoe peoples one finds in going south is weaker than its northern neighbor, from the Mapuches to the Chonos, Chilotes, Alacaloofs, and Yahgans. As we pass southward down the pampas country of Patagonia and Tierra del Fuego this same sequential relation exists amongst the foot peoples from the Mapuches to the Puhuelches, Tehuelches, Onas, and Haush.

When these migrations took place is as yet undetermined, but the vast number and size of the kitchen-middens found along the coasts, particularly in the regions of Cape Horn, indicate that the progenitors of the Yahgans at least were here long before Magellan's caravels first passed through the strait which bears his name. And it is possible that, by the scientific study of these shell heaps and their contents, the approximate time of the first migratory period might be ascertained.

The purpose of this article is to deal especially with the tribes of the

Fuegian archipelago: the Yahgans, Alacaloofs, Haush, and Onas, and with their general relationships to the southern Patagonians (Tehuelches), but more particularly with the general effect of environment on these Fuegians (Firelanders). The effect of environment is potently direct and correspondingly easy of interpretation.

From the Andean pass[2] in the vicinity of latitude 40° 30′ S., over which the Mapuches travel to and fro between the plains of the west coast and the northern Patagonian pampas, the ranges of the Andes form a practically impassable barrier—except where the Strait of Magellan breaks through—for over a thousand miles south, where they terminate in a crescent sweep

Fig. 5—The great barrier from the Alacaloof point of view: Cerro Balmadeda near Last Hope Inlet, Patagonian archipelago.

to the southeastward, along the southern half of Tierra del Fuego and the outlying islands.

This impassable wall of precipitous ice-capped peaks and dense, forested, boggy lower slopes must have barred all communication between the canoe peoples of the Patagonian channels and the foot peoples of the Patagonian plains. Likewise it barred communication between the foot peoples of the open country of northern Tierra del Fuego and the canoe people of Beagle Channel on the other side of the ranges to its south.

But there is the one great break in the barrier, the Strait of Magellan, to the eastern half of which the canoe peoples eventually paddled their frail barks and established communication with the then foot peoples of southern Patagonia. By reason of the swift currents and the open reaches, and the lack of landing places, food, and wood, together with the nomadic char-

[2] The famous Perez Rosales Pass, 3,200 feet (980 m.), the southernmost of the several passes in this part of the Cordillera.

acter of the small roaming bands of both the foot and canoe peoples, this communication—probably for the purpose of trading their meager possessions and bartering for wives—must at best have been very slight. The Patagonian mainland in the vicinity of First Narrows, where the foothills merge mountains with plains, suggests itself as their principal point of contact.

The Strait of Magellan, which broke the Andean chain, undoubtedly proved in itself to be a transverse barrier to the southward migrations of the foot peoples. That the foot peoples of Tierra del Fuego crossed from what is now Patagonia before nature depressed the earth's surface hereabouts and gave origin to this waterway is scarcely tenable. It is my opinion[3] that the canoe peoples reached Tierra del Fuego before the foot peoples and that the progenitors of the present Ona and Haush tribes, being the weaker of the foot peoples, had been driven to the southern and more arid portions of Patagonia bordering the strait and there remained until they engaged the canoe peoples to transport them to the more fertile undulating plains of northern Tierra del Fuego.

This transporting probably occurred at slack water at the narrowest portions of the eastern half of the strait, now known as First and Second Narrows. Here, thankful for the barrier between them and their enemies—probably the Tehuelches—they hunted the guanaco; and, incidentally, the Onas drove the still weaker Haush to the less propitious and more exposed southeastern corner of the island.

In Tierra del Fuego, also, the great barrier of the Andes for a long period shut off all communication between the canoe and foot peoples. To the south, however, another strait, Beagle Channel, made possible occasional communication between small groups of Yahgans and Onas, the latter occasionally working over a pass toward the eastern end of the range. Undoubtedly the Yahgans had slightly more frequent communication with the Haush than with the Onas, as they could reach their country by canoe, but this intercourse, too, was restricted by the open and exposed character of the corner where the Haush dwelt.

Brecknock Peninsula, the western extremity of Tierra del Fuego, forbiddingly intercepted frequent association between the Yahgans and the Alaculoofs, while the Taytao Peninsula, far to the north of the Patagonian archipelago, undoubtedly formed another barrier between the Patagonian channel tribes and those of the Chonos archipelago.

These barriers were undoubtedly responsible to a great extent for either the development or the perpetuation of the great linguistic differences of these tribes, for each has a distinct language. Apparently not even a "chinook," or trade language, exists between them, although in the limited

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[3] A contrary view is held by others. See discussion in "Los Indígenas de la Tierra del Fuego" by Roberto Dabenne, *Bol. Inst. Geogr. Argentino*, Vol. 25, 1911, pp. 163-226 and 247-300, Buenos Aires. This article contains a valuable bibliography.—EDIT. NOTE.

FIG. 6.

FIG. 7.

FIG. 6—Yahgan canoe of type now prevailing, Beagle Channel.

FIG. 7—Yahgan canoe, Beagle Channel; woman paddling. North coast of Navarin Island in background.

FIG. 8.

FIG. 9.

FIG. 8—Two Tehuelche men at Tres Lagunas between Gallegos and Santa Cruz Rivers. Note the plains country. (Copyright by Charles Wellington Furlong.)

FIG. 9—Interior boggy country of Tierra del Fuego: Part of the Furlong expedition on north side of the Tierra del Fuego coast range. Note black on pack saddle of center horse, caused by the animal having just been "bogged."

vocabulary of the Haush obtainable I find a number of words identical with the Ona. This fact, however, is readily explicable, for there is no great natural barrier, only difficult traveling, between the territory of the Ona and the Haush, and contact must have been much more frequent than between the other Fuegian tribes. This circumstance also has perhaps been responsible for the near extinction of the Haush.

Otherwise the barriers have made for the isolation, hence the preservation, of the weaker tribes. These people were able not only to hold their own, but to thrive against those cohorts of nature, storm, cold, dearth of food; but the coming of the white man with the artifices, vices, and diseases of civilization was as the touch of a deadly thing. Moreover his attitude before long became that of active enmity: he was covetous. He wanted the northern open country of Tierra del Fuego for his sheep; hence he drove the Onas from their hunting grounds to the thick impenetrable forests and bog-soaked mountainous regions of the southern half of their islands, where no man cared and few men dared to follow.

Its unattractiveness made Fuegia an asylum. Here is a sub-Antarctic climate, where grains do not ripen, where in its most protected parts under care only the hardiest bulbous vegetables can be counted on to stand the frosts. This condition is not due so much to extreme cold or length of winter as to lack of heat in summer, for even in December, the Fuegian midsummer, gales of sleet and snow are often of hourly occurrence. It is "a land where nature seems not only to resent the intrusion of mankind, but at every hand to thwart and harass his existence." It caused its inhabitants long to be dissociated from the world; its limitations of primary resources forced them into an existence of almost unsurpassed nomadism and primitiveness which, in turn, has had a very direct effect upon their social organization.

In the first place, the Yahgan's environment has limited his food supply. It consists of perhaps twenty varieties of fungi, mussels, limpits, fish, shore and sea birds and their eggs, seals, and the blubber of an occasional stranded whale. Environment also makes this scant variety most hazardous in the getting. The Yahgan must dive into the icy waters for shell fish, scale dangerous cliffs for eggs and venture into the storm-swept channelways, broad reaches of the sounds and the very oceans themselves in search of these things. To obtain food the Yahgans have perforce become a canoe people: their principal, though crude, craftsmanship is canoe building.

Before the recent acquisition of white men's clothes, their limited native clothing consisted of a skin of seal or sea otter, used as a sort of shoulder cape; otherwise they went naked. Thus their environment forced, to a marked degree, the survival of the fittest.

Their conical or semi-spherical wigwams of beech boughs, sometimes walled with slabs of bark and pitched on mussel heaps, are among the most primitive in existence; nomadism prevented the developing and

building of permanent domiciles. Architectural development, like the invention of domestic conveniences, comes from reasonable permanency of abode and from gregariousness. With the Yahgans these are impossible.

All of these conditions have affected their physique. The tallest Yahgan (Beagle Channel) I ran across measured 5 feet 9¾ inches, and, of some fourteen measurements of males taken, the average was 5 feet ⅞ inch, the women being relatively shorter. This is due to shortness of leg rather than of body and is particularly noticeable in the women, who do most of the paddling and whose walk is a waddle. Their legs have become stunted through continuous squatting in canoes. Yahgan children are well formed and proportioned. At the missionary John Lawrance's ranch at Laui on Beagle Channel there were over a dozen Yahgan youths all of whom were well proportioned. Why? Because they had spent the greater part of their lives in active work ashore, herding sheep on the ranch.

Although the Yahgan is as gregarious as his food supply and *wanderlust* will permit, his opportunities for communal intercourse are necessarily limited. Occasional gatherings of a hundred or more may occur at the driving ashore of a stranded whale, but the greater part of the time the people are scattered about the archipelago in single families or two perhaps, living isolated far from their central meeting places.

This primitive social organization in turn affects the form of government. Each canoe may be said to represent an independent authority, the most complete form of government known among the Yahgans. In answer to the blue signal smokes for the gathering of the families, they assemble at some fixed rendezvous, dwelling as a community perhaps for some weeks, each bringing with him that inflexible independence which will owe allegiance to no man, and in consequence they have no chiefs.

They do, however, occasionally show deference to a *yuccamoosh* (medicine man), or to a wise older man, and revere experience and physical prowess. They are strongly socialistic, but only lack of greater communal intercourse is responsible for their lack of leaders. The absence of this most elemental attribute, chieftainship, which even the most barbaric of races usually acquire, is one characteristic which pre-eminently distinguishes them from the rest of mankind.

The Yahgan's environment, through its effect on his social organization, has naturally had a marked effect on his customs. Through lack of social organization there has been a lack of development of rites, ceremonies, and all that complexity of social usage in which customs are developed and involved. Those customs which they have are in many cases directly affected by their material environment. Take, for instance, the matter of personal decoration. Whether for pure love of decoration itself or as a symbol of war or death, it is limited to their own crude resources: shell necklaces, head fillets of down, simple bracelets of sinew, or the three somber color pigments, charcoal black (*yupooshug*), dull white (*toomoorahbo*), and dull

red ochre (*emi*)—earthly material found along the shore which, ground to powder, is used to besmirch their bodies.

Their industries are limited to their simple needs and the materials nature produces to supply them—sinew for their strings, fish line and sling cords; whale or seal bone for their spear-heads, and wood for their shafts; shells for saucers; a wild carex, from which the women weave, with a peculiar knot, their baskets; iron pyrites, from which with difficulty they make their fires; the big slabs of thick bark and whalebone from which their most honored men, the expert canoe builders, construct their craft. To such meager materials nature has restricted her southernmost children of the world.

These Yahgans have been classed as the most savage and least developed people of the world, addicted to treachery, bloodthirstiness, and even cannibalism. The sight of a long-haired figure crouching within his wigwam of beech boughs, dwarfed and stunted from squatting in canoes, large-headed, with a countenance rendered hideous by the fight for existence against cold, want of food, and isolation, would seem to bear out these statements, but I doubt if his white brother, dwelling under these conditions, providing he could survive, would be more attractive in appearance.[4]

There is an absence of any form of worship or religion in the general acceptance of the term. Although the Yahgan is both an animist and a polydemonist, weird nature, whose phenomena he has personified in his imagination, has also by her exigencies dwarfed his introspection. When a man dies "he is gone" the Yahgans say,—"is no more." They blot out his memory, do not mention his name, split his canoe in twain, and destroy his belongings.

Like causes, with like resultant effects, have controlled the development of the Alaculoofs. The Alaculoofs resemble the Yahgans in general appearance, customs, and character, but they are better clothed and of sturdier fiber. They are quite untractable, and their language is distinctly different. They have pushed the Yahgans south and occupy a slightly better territory. The barrier of Brecknock Peninsula has served to keep their language distinct from that of the Yahgans. Today only a few chance canoes of these people are seen. Their decrease, tribal groups and settlements, as well as that of the other tribes, will be taken up in a succeeding article.

The Onas, like the Yahgans and Alaculoofs, have no proto-history or history of themselves. Their features are of Mongol type, and they resemble the Yahgans in many ways but are of much finer physique and may be considered a tall people. The average height of eleven I measured was 5 feet 9 inches, the tallest, Pupup, being 6 feet 1 inch. I was impressed with the fact that these latitudes and this climate seem to induce growth,

4 A study of the mentality of these people, especially on the phenomena of psychoneuroses, has been made by me in collaboration with the well-known psychopathologist, Dr. Isador H. Coriat of Boston. See his paper read at the sixth annual meeting of the American Psychopathological Association and published in the *Journal of Abnormal Psychology* for August and September, Boston, 1915.

Fig. 10—Onas, Tierra del Fuego. These primitive folk still live the life of the Stone Age. (Photo copyright by Charles Wellington Furlong.)

a phenomenon also noticeable in instances of white men as well as certain of the limited fauna of that land.

The Onas have heavy malar bones and supra-orbital ridges. Their head hair is dark, full, but not coarse. Like the Yahgans, they have splendid teeth, their hands and feet are small and well formed and their fingers are rather delicate and tapering. Darwin records the color of a few Fuegians (Haush) he met on the shores of Beagle Channel as a dirty coppery red, but this undoubtedly was due to the red ochre with which they had bedaubed themselves. It was not until I had seen some ochre being washed off that I discovered their true color, cinnamon in quality, but much lighter in value.

Forced by their environment to live by the chase in a hard land, they have acquired a strong physique and have developed wonderful endurance and exceptionally acute powers of smell, sight, hearing and sense of location. For, despite the thick forests and verdure of their land, there is a dearth of food. In part the Onas' food supply is the same as that of the Yahgans. Birds, by reason of their land hunting, are used more and fish less. To these may be added the *cururo* (*Centomys*), a kind of ground rat. But the staple food of their nitrogenous diet is the *guanaco* (*Auchenia huanaco*), often hunted with large, powerfully built hounds, resembling a cross between a Great Dane, stag hound, and setter.

The Onas are even more dependent on the guanaco[5] than were the North American Indians on the bison: its meat is their food, its warm, hairy, woolly coat, their clothing; and its hides, cured, sewn together and rubbed with red ochre, serve as a traveling wigwam. Its hide is sewn into small water-bags and cut into strips for cords, portage harness, and girdles; the sinew from the loin is twisted into bow strings and the filaments separated into thread. Even its bones are turned into primitive awls.[6]

Besides the limited fauna already mentioned, the Fuegian wolf fox is the only other large quadruped. The limited food supply, greatly diminished since the Onas have been driven south by the white man, has been responsible for the greater clannishness, inducing warfare. Often, in the belly pinch of hunger, groups trespass on their neighbor's territory. The result—a feud. However paradoxical it may seem, these feuds have probably helped to preserve the Onas, thus adjusting them numerically to their food supply and maintaining in this respect the balance of nature.

Tierra del Fuego, with a greater and more dependable food supply than the smaller islands, permits of more permanent shelter building. The Ona builds both a primitive type of bower wigwam with branches stuck in the ground interlaced and inclined toward the center, and a sort of semi-wigwam made of guanaco hides, which he uses in traveling. He has

[5] For description of the guanaco and Ona hunting methods, with plans, see C. W. Furlong: Hunting the Guanaco, *Outing Magazine*, October, 1912.

[6] See the Furlong collections in the American Museum of Natural History, New York, the Peabody Museum, Harvard University, Cambridge, Mass., the Peabody Museum, Salem, Mass., and the Museum of the American Indian, Heye Foundation, New York.

also developed two types of heavy log shelters, one cone-shaped, the other gable-shaped.

The Onas must travel afoot and carry all they possess on their backs, hence their use of a cargo harness of strips of guanaco hide. The men travel light to be prepared against a surprise attack or to secure a fleeting guanaco, the women carry on their backs the rolled-up tent with the simple camp appurtenances, with the young children in a fold of the cloak at the back of the neck. Their environment has developed a well-balanced division of labor among them, the men getting the guanaco and skinning the pelts, the women curing them; the men protecting the camps and their families from enemies, the women caring for their camps and their families; the men making their bows and arrows and certain other utensils, the women weaving reed baskets, making water-skin bags, etc.

The scarcity of food involves long journeys and militates against gregariousness, so the Onas, like the Yahgans, are forced into small clans or family groups, each for himself and his own and each group hunting in its special territory. This severe existence, alone with the elements and frequently in the country of an enemy group, has developed self-reliance, courage, stoicism, and individual independence rarely equaled, with the result that the Onas render obedience to no man. Hence they are without chiefs, but, like the Yahgans, will pay deference at times to their medicine man, whom they call *J'ho'n,* or to an elderly man of character and physical prowess. They are socialistic in their tendencies, the hunter dividing the food with the camp.

Their customs, though slightly more advanced and complex than those of the Yahgans, follow the same trend, particularly in respect of face and body painting, the ceremony of initiation into maturity, songs, doctoring and necromancy, freemasonry and superstitions conceptions. These, like their meager industries, are directly dependent on the limited physical assets of their environment. The difference between a foot people and a canoe people marks the industrial differences. The Onas were never known to build a canoe or the Yahgans to make a guanaco-skin wigwam. The Onas, a people practically living in the life of the Stone Age, produce a splendid and beautifully wrought bow and arrow.

Undoubtedly gross exaggerations have arisen concerning the Fuegians. As far as I could discover, they never used poisoned arrows, although accused of so doing, and undoubtedly they never practiced cannibalism as a rite, although, like some of their white brothers, they may have resorted to human flesh when face to face with starvation. While their elemental passions are strongly developed, they have tractable and likable qualities, and I believe are inherently intelligent. The more I have seen of these and other primitive tribes the more I am convinced of the direct and potent influences of environment. Narrower, too, to my mind, has grown the gap which some would have us believe exists between primitive and civilized man.

THE FRONTIER REGION OF MEXICO

Notes to Accompany a Map of the Frontier*

[With separate map, Pl. I, facing p. 24.]

The revolutions of Mexico may be said to have two breeding places. One is the broken, hot, and relatively moist country south and southwest of the capital city; the other is the long, desert, frontier region of the north. It is the latter that is of chief interest to citizens of this country. One of Mexico's most enthusiastic propagandists once likened the general shape of his fatherland to a cornucopia, or horn of plenty, and dwelt on the riches poured therefrom into the United States. But since military operations have been undertaken in the frontier region by revolutionists and by government troops of both Mexico and the United States, troubles rather than riches have been our chief importations from Mexico. And in the past few months much of the romance that has been associated with the memories of Spanish times has faded before the hard realities of military life in the hot, dry country through which runs the 1,600 miles of Mexican frontier.

The extended frontier of northern Mexico, lying for the most part in desert country, offers two chief difficulties to military transport: forage and water for beasts and long, sandy, or broken stretches difficult to cross. If motor transport be employed the military road becomes the chief immediate problem unless the field of operations is supplied by a railway, when its possession becomes one of the first objectives. Since labor is now nearly impossible to get, and since the materials must be hauled long distances in the United States before reaching the frontier, we may say that the problem is rather more changed in form than diminished in difficulty when we haul camp equipment, food and ammunition, medical stores and wounded by motor truck instead of horse power. Wood for fuel is still desirable, and to avoid the transport of water for the troops it is necessary to know the infrequent watering places.

There are a number of standard questions which the military man raises on looking over the possibilities of such a region. Where are the river bottoms with trees, and open plains with scrub, and mountain ranges with forest or woodland? Where are the springs and wells and desert "tanks"? Of railroads we shall speak later. At this point we wish to emphasize the character of military operations in places not reached by railroads. For the three main railway lines supply only a part of northern Mexico. And a military campaign directed against a revolution in that region, either by a central Mexican authority or by American forces, must always confront the problem of reaching in force those remote sections that are the haunts

*As to drainage, roads, and towns, the map is based on the "Map of Sonora, Chihuahua, and Coahuila, Mexico," 1:1,000,000, published in 1913 by the War College Division of the General Staff, Washington, D. C. For other sources see footnote 1.

of guerilla bands and small fugitive detachments. Trench warfare can be carried out only on the most limited scale. The power of concentration in a desert is limited even on the part of a rich nation. Northern Mexico has always been desert and it is now destitute. In the past few years trenches have been made around some of the besieged towns, but the trench stage has been short and has always been preceded and followed by tactical fighting in open country. The long and difficult march, the unexpected concentration of guns and men, in fact all the elements of surprise, are still possible over most of the frontier region.

The following notes deal with those features of the relief, climate, and vegetation of the frontier that are involved in one form or another in the problems of military control. They are followed by a reference to railways and by a note on the cities of Mexico, the two chief objectives in a protracted campaign.

The accompanying map, Plate I, represents the desert quality of the frontier region of the Southwest—the limited rainfall and the high temperatures of summer. An oval belt of exceptionally high temperature extends along the Rio Grande, and the same extremes appear again at the head of the Gulf of California. The whole region has most uncertain rains. In a single year from 12 to 20 inches of rain may fall, only to be followed by years of extreme drought, with a rainfall of but a few inches. El Paso is typical, with a rainfall as high as 18.30 inches in 1884 and as low as 2.22 in 1891.[1]

But let it not be supposed that the whole frontier region has a uniform climate and relief. The region may be divided into a number of natural provinces. At the extreme western end of the boundary and west of the Colorado River is a group of minor ranges in Southern California. East of the Colorado River is the Lower Colorado Basin of southwestern Arizona. Then comes a group of ranges which lie in southeastern Arizona and are continuous with the Sierra Madre of Mexico, the chief relief feature shown on Plate I. From El Paso southeastward runs the valley of the Rio Grande with various mountain ranges and knots on either hand such as the Guadalupe Mountains in western Texas. The lower Rio Grande runs through plains country.

Only a word is required for the westernmost section of the boundary. The frontier region here includes block mountains of less height but of the

[1] The climate, relief, and vegetation as set forth in the following description are taken with modifications from "Forest Physiography" by Isaiah Bowman, 1911. See the chapters on the Lower Colorado Basin and the Arizona Highlands, pp. 244-245 and 249-250.

The chief sources of climatic data for the map (Pl. I) were Bartholomew's "Atlas of Meteorology" and the monthly bulletins of the Observatorio Meteorológico-Magnético Central de México. The isohyets and January isotherms are based chiefly upon the former, the July isotherms upon the latter. For the immediate border region the various United States publications consulted include *U. S. Weather Bureau Bulletins Q and S, U. S. Geol. Survey Water-Supply Paper 301*, 1912 (Pl. I), and the wall map of Normal Annual Precipitation of the United States by Eugene Van Cleef (Rand-McNally Co., 1915).

Hann's "Handbuch der Klimatologie," Vol. 2, gives data for a few localities in northern Mexico, and a rainfall map is shown on p. 76, Vol. 1, of "Le Mexique au XX^e Siècle" (see bibliography at end of article).

FIG. 1—The river front of El Paso, Texas, with the Rio Grande in the middle ground and the Mexican town of Juarez beyond. Note the low stage of the river, characteristic of the greater part of the year, due to the general aridity of the climate. (Photo copyright by Underwood & Underwood.)

Fig. 2—The manoeuver field of the expeditionary force near the base camp at San Antonio, northern Chihuahua. The view is typical of the arid plain of this region, from which rise, island like, mountain ranges here and there, as in the right background. Note the ditches and the water hole in the foreground. (Photo copyright by Underwood & Underwood.)

same general character as the San Bernardino and San Jacinto Mountains of Southern California. The boundary crosses the Imperial Valley, famous no less for its position below sea level than for its fertile irrigated lands.

The region east of the Colorado River consists of lowlands with an extreme desert climate. The average precipitation along the entire boundary is about 8 inches and on the Yuma and Colorado Deserts it is but 2 or 3 inches. For 700 miles between the Rio Grande and the Pacific, the boundary line is crossed by only five permanent running streams. There are two periods of rainfall, one in midwinter and one in midsummer, the midsummer rainy period being known as the rainy season. The summer rains generally begin about the first of July and last until the middle of September. Soon after the first rain falls the vegetation assumes a spring-like aspect, leaves burst forth, hills and valleys are covered with grass, and a bewildering profusion of wild flowers covers the surface. The plants grow with great rapidity, their seeds mature before the rains cease, and in a month or so after the rains have stopped they have the somber colors typical of fall and winter.

On the whole the Mexican boundary district of the Lower Colorado Basin is treeless; the forests are confined almost entirely to the mountain ranges and the stream courses, but those in the latter situation are few in number and of insignificant size. On some of the desert spaces arboreal cacti and yuccas form open groves; on others, and especially the alkali spots, the ground is perfectly bare of vegetation. The streams are lined with Fremont cottonwood, black willow, box elder, walnut, sycamore, oak, mulberry, and ash.

Shrubs and grasses increase in number and variety on the foothills, and there is often an abundance of shrubbery in the ravines near timber line. The desert vegetation, with the exception of a few green-bark trees and shrubs, is dull and dusty and in general the plants have pulpy leaves, gums, and resins. Under 4,000 feet the rainfall is so low and the evaporation so high that true desert conditions prevail.

Upon the higher mountain slopes are limited areas with greater precipitation; hence islands of vegetation occur on the mountains, surrounded by great desert plains. The highest portion of the Lower Colorado province lies in south-central Arizona and includes a few mountain ranges—the Baboquivari, Carobabi, and Cobota Ranges—which break the continuity of the plains. The Gila, Mohawk, and Growler Mountains are important ranges farther west. None of them has a sufficient summit extent to provoke large quantities of rainfall, hence even the highest portions are scantily covered with tree growth.

There is a thin population along the entire boundary in the Lower Colorado region, the only towns of consequence being Douglas, Santa Cruz, Nogales, Yuma, and San Diego. Except for these towns and several score of small settlements in the principal valleys the boundary

zone between El Paso and the Colorado River has few permanent inhabitants.

The Arizona Highlands of southeastern Arizona are continuous with the Sierra Madre of Mexico and from a distinct province of the frontier region, extending across the boundary. They make a relief much more broken and distinctly higher than that of the Lower Colorado Basin province just west. Ranges worthy of mention are the San Luis (south of the boundary), San Jose, and Dog Mountains. At the summits of some of the main peaks is the Mexican white pine; on others, and growing at lower elevations also, is the yellow pine. In the fifty-mile desert west of El Paso are open "forest" patches of desert yucca, where the largest trees attain a height of 16 feet. The Fremont cottonwood is the most common, beautiful, and valuable shade tree in the whole Mexican boundary region. It grows naturally on almost every stream along the boundary and is found planted around the houses and along the irrigation ditches of almost every ranch.

A common tree or shrub through the desert Southwest is the mesquite. The vertical range is from sea level and even below sea level in the Colorado Desert up to about 5,500 feet. In the deserts of New Mexico, Arizona, and California it is a shrub which obstructs drifting sand, thus forming mounds of sand and lines of sand hills; in the most fertile places along the Colorado River and its tributaries it is a tree of considerable size. Along the Santa Cruz River in Sonora are forests of unusually large mesquite, with some individuals 2½ feet in diameter and 50 feet high.

The Rio Grande Valley consists of a string of basins connected by "shut-ins," narrower stretches where the river has cut across low ridges flanked by hills or mountains of moderate height. The Rio Grande is a storm-water stream, subject to great and sudden floods. The rainfall occurs principally in the form of violent showers or cloudbursts, which fill the dry or nearly dry stream beds of the tributaries with turbulent floods of short duration. Occasionally such floods rising at the same time in several tributaries destroy the irrigated lands of the main valley floor, where are located almost all of the principal towns.

The valley floor consists of alluvial lands cut into terraces by the river. The broadest terraces lie in the most noted basin of the valley, the "Jornado del Muerto," or "journey of death," in south-central New Mexico. It is 200 miles long by 30 or 40 miles wide, with abrupt and in places mountainous borders. The alluvial floor of the basin has a growth of grasses and stunted shrubs. Along the river bottoms are cottonwood trees. On the slopes at the basin margin with low elevations are yucca and cactus and higher up there is a scrubby growth of juniper, cedar, and oak. On the bordering ranges is a scattered tree growth, if the ranges are low; if high, they bear important growth of pine and fir. The Chisos, Davis, and Capitan

Ranges, and especially the Sacramento Range, have true woodland and forest growths between the 7,000-foot contour and the summit.

With the chief features of the relief, climate, and vegetation of the frontier in mind we may now turn to the location of the railways. They are a key to much of the military history of the region. Plate I shows the location of the three principal lines, one on the west which reaches Nogales, one in the center which terminates at Juarez opposite El Paso, and a third which crosses the Rio Grande at Ciudad Porfirio Diaz (Piedras Negras) half-way between El Paso and the Gulf. The value of the railways may be illustrated through their use by Huerta. His strategy consisted in keeping his soldiers posted, (1) in towns on the railway lines, (2) at border stations, (3) in the large cities whatever their location. Control of the railways has been essential to the life of one after another of the disorders of the frontier, since large quantities of the necessary supplies have been imported over these lines from the United States. Revolutions have therefore started at outlying points with the appropriation of livestock which could be driven with the army and used as needed for food. Horses for mounts and mules for pack-train transportation could also be taken by force. Villages and groups of ranches became bases from which to launch attacks and furnished rough field hospitals for the wounded. Control of a section of one of the three main railways has always been one of the first objectives of a revolution in the desert country of northern Mexico.

Two years ago Professor Mark Jefferson wrote a short but very interesting account[2] of the relation of some aspects of Mexican geography to the revolution then in progress. His remarks are even more important at this time and may be quoted with but slight modification as follows:

"It is not generally realized that the revolutionary area in Mexico is far from the homes of the mass of the Mexican people and above all far below the level at which they live. Mexico is a curiously 'upstairs' country. Most of the people live on a plateau more than five thousand feet above the sea. This plateau area is outlined on the accompanying map (Fig. 5) with a dotted line. Its association with Mexican life is shown by putting on the map all the towns upwards of ten thousand people in 1910. It is evident at a glance that they are massed especially on the plateau. The population of the towns is roughly shown by the marks that represent them on the map, dots for ten thousand, bars for twenty, triangles for thirty, squares for forty, and circles for fifty thousand. Sixty thousand is shown by a dot within a circle, and so on. Three cities at the high, southern end of the plateau have over a hundred thousand: Guadalajara (118,799), Mexico (470,659), and Puebla (101,214).

"The revolution has not yet got up to this plateau, holding only the

[2] Mark Jefferson: The Revolution and the Mexican Plateau, *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, pp. 436-437, with map (here reproduced as Fig. 5).

Fig. 3.

Fig. 4.

Fig. 3—Field artillery of the expeditionary force on the march, northern Chihuahua. Note the sparseness of the desert vegetation, only the water courses, as in the background, being lined with trees. (Photo copyright by Underwood & Underwood.)

Fig. 4—Soldiers from the expeditionary force watching Mexicans trying to construct a bridge over the Santa Maria River near El Valle, northern Chihuahua, which had been destroyed by a flood. The first bridge had been built by the engineers of the expeditionary force. The landscape is typical of that along the watercourses. (Photo copyright by Underwood & Underwood.)

northern country as far south as Torreon and some of the low country about Tampico in the east and south of the plateau border between Mexico and Guadalajara. The only cities of any size that the rebels hold as yet (May 7, 1914) are Chihuahua (39,061) and Monterey (81,006). Chihuahua is in the north, just off the plateau border and too far away from the Federal base for the Federals to hold, so they abandoned it. Monterey is also off the plateau, at only 2,000 feet, by far the largest city at so low a level.

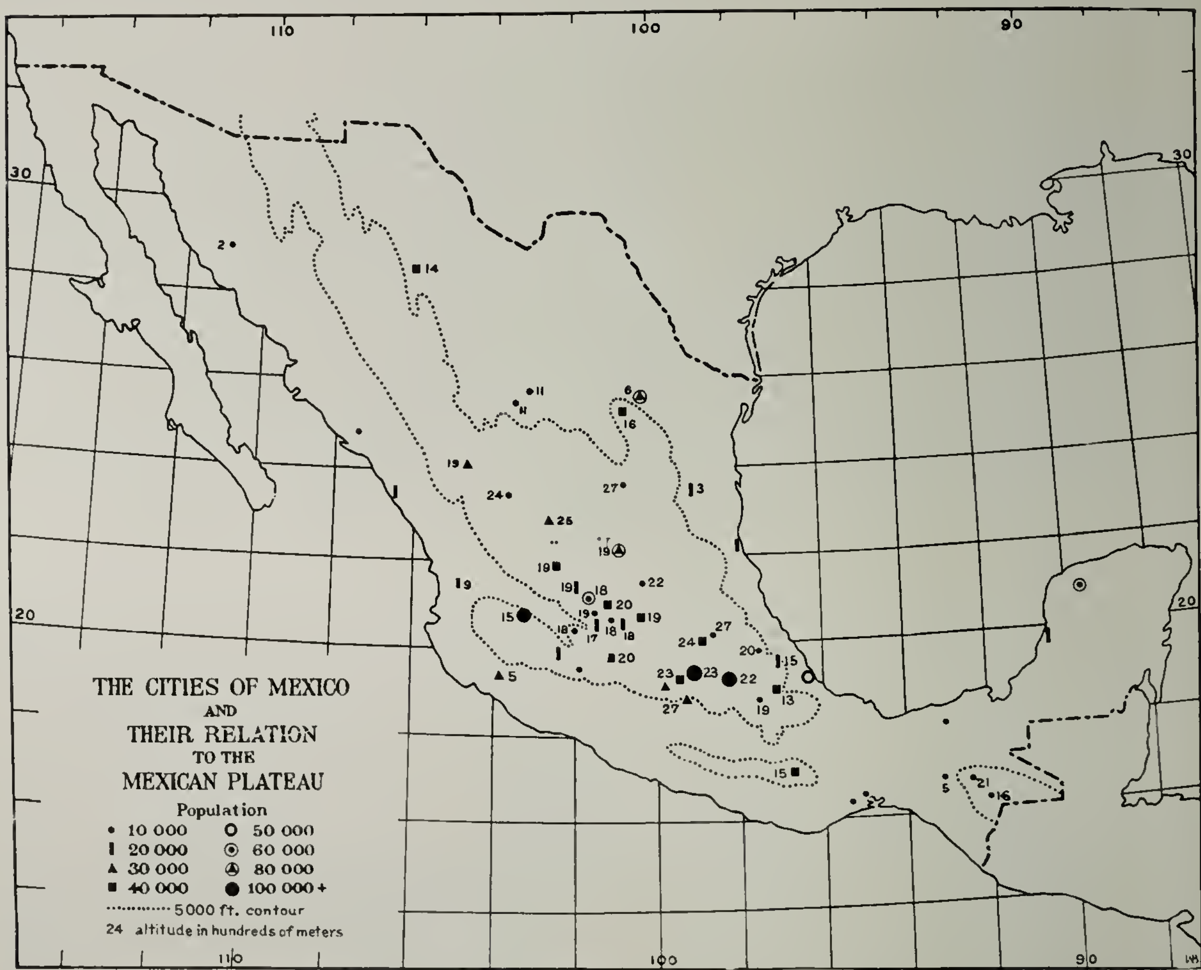

FIG. 5—Sketch map of Mexico showing the relation of the cities to the plateau. Scale, 1:26,000,000.

Saltillo (35,063), near it, is on the plateau, but this the rebels have gone by for the fighting near San Luis Potosí. Torreon is a small place. The population has not yet been reported for 1910, but ten years ago it was 13,800. The *area* held by the rebels is very large, perhaps a third of Mexican territory, but a great deal of it is uninhabited, with certainly less than one and a half of Mexico's fifteen million people, a bare tenth of the population. The task of the rebels is thus still mainly ahead of them.

"The cities of forty thousand (the squares on the map), are, from north to south: Chihuahua (39,061). Saltillo (35,063), Aguas Calientes (44,800), Guanajuato (35,147), Querétaro (35,011), Pachuca (38,620); then west of Mexico City, Morelia (39,160), close to the capital, Tacubaya (35,830), and, toward Vera Cruz, Orizaba (36,189). Oaxaca (37,469)

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stands isolated on a five-thousand-foot upland of its own farther south. The cities of thirty thousand (triangles) are: on the plateau southwest of Torreon, Durango (34,085); southeast of it, Zacatecas (25,905); near the capital, Toluca (31,247); and on lower ground nearer the west coast, Colima (25,148).

"Close beside each city symbol is a little number giving its elevation in hundreds of meters. These figures show that the larger cities are on higher ground near the southern end of the plateau about Mexico City, at elevations of seven or eight thousand feet. The heart of Mexico is now as always most vulnerable from Vera Cruz, on account of the nearness of the thickly settled regions to the sea in that neighborhood, though the ascent is steepest there and the low ground to be passed through most unwholesome."

At the request of this Society, Professor Jefferson has supplemented his former comments with the following paragraphs:

"The Mexican situation at the present, December, 1916, is quite different from that of the spring of 1914; but the scene of action is the same portion of the Mexican Republic, the thinly settled, desertic, and arid north. Even a strong government would have trouble maintaining order in a region so poor in food and water, where the only thing that abounds is empty space. Given a desperate insurgent who is inured to hunger and thirst, in such a region he finds his best theater of operations.

"Turkey finds the problem of Arabia equally difficult, and has always found it so, for the geographic obstacles are the same. If the United States undertakes the pacification of northern Mexico she will have the same difficulties to solve. American troops may be trained to ride like Mexicans, to find their way and fight in the desert like them, but they cannot hope to match them in *doing without,* an art in which the Mexican has a life-long training, and the American none. For this reason the problem of reducing northern Mexico will involve supply trains that will be costly out of all proportion to the numbers involved. It will not be comparable to the former Mexican war, which was a war with a government established in the heart of Mexico and attacked there."

A Selected Bibliography of Geographic Material on Mexico

General Works

C. R. Enock: Mexico: Its Ancient and Modern Civilisation, History and Political Conditions, Topography and Natural Resources, Industries and General Development. T. F. Unwin, London, 1909.

P. F. Martin: Mexico of the Twentieth Century. 2 vols. Edwin Arnold, London, 1907.

N. O. Winter: Mexico and Her People of Today. Page and Co., Boston, 1907.

Prince Roland Bonaparte, Léon Bourgeois, Jules Claretie, d'Estournelles de Constant, A. de Foville, Hippolyte Comot, O. Gréard, Albin Haller, Camille

Krantz, Michel Lagrave, Louis de Launay, P. Leroy-Beaulieu, E. Levasseur, General Niox, Alfred Picard, Elisée Reclus: Le Mexique au Début du XXe Siècle. 2 vols. C. Delagrave, Paris, 1904.

Matias Romero: Geographical and Statistical Notes on Mexico. G. P. Putnam's Sons, New York, 1898. [Expanded from a paper in *Bull. Amer. Geogr. Soc.*, Vol. 28, 1896, pp. 327-386.]

Matias Romero: Mexico and the United States: A Study of Subjects Affecting Their Political, Commercial, and Social Relations, Made with a View to Their Promotion. G. P. Putnam's Sons, New York, 1898. [Both books by Romero have long been standard works of reference. The second contains a reprint of the first.]

—— The Mexican Year Book: A Financial and Commercial Handbook, Compiled from Official and Other Returns. Issued under the auspices of the Department of Finance, Mexico City, New York, and London. [Since 1906: contains material brought up to date.]

—— *Commerce Reports* (formerly *Daily Trade Reports*). Bureau of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C. [Source of much useful information, as for example the note on irrigation and farming in the Imperial Valley of northern Lower California, *Daily Consular and Trade Repts.*, No. 192, 1913.]

Mexico in Relation to Revolutions

H. H. Bancroft: History of the Mexican People, Being a Popular History of the Mexican People from the Earliest Primitive Civilization to the Present Time. The Bancroft Co., New York, 1914. [On p. 348 is a map showing the areas occupied by the revolutionists in 1813. They were concentrated in the remote districts of the south.]

L. Gutierrez de Lara and Edgcumb Pinchon: The Mexican People: Their Struggle for Freedom. Doubleday-Page Co., Garden City, N. Y., 1914. [Discussion of the agrarian policy under Diaz is accompanied by a map showing localities where peasant-farmers were dispossessed of their lands.]

Carlo de Fornaro: Carranza and Mexico. With chapters by I. C. Enriquez, Charles Perguson, and M. C. Rolland. Mitchell Kennerley, New York, 1915. [One of the most interesting features of this ''inside view'' of Mexico is the map showing the strategic railroad lines (p. 114).]

Geography of Northern Mexico

Dillon Wallace: Beyond the Mexican Sierras. A. C. McClurg Co., Chicago, 1910. [A well-written account of the author's travels in the trans-Sierra country between the states of Sonora and Jalisco.]

E. C. Hovey: The Western Sierra Madre of the State of Chihuahua, Mexico. *Bull. Amer. Geogr. Soc.*, Vol. 37, 1905, pp. 531-543. [Topographic barriers to communication are well illustrated in this article.]

O. H. Howarth: The Western Sierra Madre of Mexico. *Geogr. Journ.*, Vol. 6, 1895, pp. 422-437. [A concise geographical study.]

Carl Lumholtz: New Trails in Mexico: An Account of One Year's Exploration in Northwestern Sonora, Mexico, and Southwestern Arizona, 1909-1910. Charles Scribner's Sons, New York, 1912. [An invaluable study in the human geography of the region ''formerly called Papagueria.'' A summary account may be found in the author's article ''The Sonora Desert, Mexico,'' *Geogr. Journ.*, Vol. 40, 1912. The article is followed by notes on the same region by I. N. Dracopoli.]

D. T. MacDougal: Across Papagueria. *Bull. Amer. Geogr. Soc.*, Vol. 40, 1908, pp. 705-725. [A brief narration of the itinerary from oasis to oasis of the expedition de-

spatched from the Carnegie Institution Desert Laboratory at Tucson, Arizona. The main features of the vegetation are also outlined. A detailed study of the vegetation of this and other desert areas from the Great Basin in Nevada to southern Mexico is offered by D. T. MacDougal's ''Botanical Features of North American Deserts'' (*Carnegie Inst. Publs. No. 99,* 1908). An important recent paper is Forrest Shreve's ''The Vegetation of a Desert Mountain Range as Conditioned by Climatic Factors'' (*Carnegie Inst. Publs. No. 217,* 1915). It describes the Santa Catalina Mountains north of Tucson.]

E. A. MEARNS: Mammals of the Mexican Boundary of the United States: A Descriptive Catalogue of the Species of Mammals Occurring in that Region, with a General Summary of the Natural History and a List of Trees, *Bull. U. S. Natl. Museum No. 56,* Part I. Washington, D. C., 1907.

W J MCGEE: The Seri Indians. *17th Ann. Rept. Bureau of Amer. Ethnol.,* 1895-1896, Pt. I, pp. 1-344* (duplicate pagination). [Standard ethnographical description of the Indians inhabiting Tiburon Island in the Gulf of California and a limited area of the opposite shore of the state of Sonora.]

W J MCGEE and WILLARD D. JOHNSON: Seriland. *Natl. Geogr. Mag.,* Vol. 7, 1896, pp. 125-133. [Based on the preceding.]

Boundary Surveys

W. H. EMORY: Report on the United States and Mexican Boundary Survey, made under the direction of the Secretary of the Interior. 2 vols., Washington, D. C., 1857-58; also as *34th Congr., 1st Session, Senate Doc. 108* and *House Doc. 135.* [Contains detailed narrative by Emory and reports on the geology and physical geography of the boundary region by C. C. Parry and Arthur Schott. Accompanied by a map in 4 sheets on the scale of 1:600,000.]

—— Proceedings of the International (Water) Boundary Commission, United States and Mexico, Treaties of 1884 and 1889: Equitable Distribution of the Waters of the Rio Grande. 2 vols. State Department, Washington, D. C., 1903. [Contains a detailed map (1:10,000) in 54 sheets of the coastal plain segment of the Rio Grande, showing the shifting of the channel since 1853.]

—— Report of the Boundary Commission upon the Survey and Re-Marking of the Boundary between the United States and Mexico west of the Rio Grande, 1891 to 1896. 3 vols. (i. e. text, album of views, and atlas). State Department, Washington, D. C., 1898. [The atlas contains 18 sheets on the scale of 1:60,000, covering the boundary from El Paso to the Pacific.]

CENTRAL ENGLAND DURING THE NINETEENTH CENTURY: THE BREAK-DOWN OF INDUSTRIAL ISOLATION

By B. C. WALLIS

"Man's reaction to his environment" defines summarily the subject-matter of the science of geography, and it is the purpose of this paper to demonstrate certain aspects of the reaction which has occurred in a certain area of central England (indicated in Fig. 1). The backbone of England, the Pennine upland, is terminated to the south by the sweep of the valley of the Trent, which rises near the boundary of the county of Cheshire, crosses the counties of Stafford, Derby, and Nottingham, and finally emerges into the Humber. The area under examination includes the southern portion of these Pennine hills, the Trent valley, and the lowlands which fringe the Pennines both to the east and to the west. For convenience of investigation the area is that of the counties of Nottingham, Derby, and Cheshire as well as the northern portion of Staffordshire. This area is not a geographical region, since it includes portions of both eastern and western England; it is not a definite geographical unit, since the variety of its minerals has given rise to various conditions of life. Although it forms a part of the area to which the name "industrial Britain" has been applied, it cannot be regarded as a typically industrial area, since there are many farmers within its boundaries. The district is a connecting link, an area of transition, which lies between the great textile areas of Lancashire and the West Riding of Yorkshire and the great iron area centered upon Birmingham, the "black country." Such an intermediate area will probably serve better for the purposes of a geographical investigation than a geographical region, or a typically industrial district, since it will continually enforce comparisons between, for example, the effects of coal and salt, or between the lives of farmers and factory hands.

The investigation covers the period of the nineteenth century, since the complete inquiry deals with changes which have occurred within a definite period of time, and since the nineteenth century has many conveniences when considered as a period of change.

The people who inhabit the district are largely native to the area; statistics of migration tend to show that there has been some influx of people from other parts of England but that there has also been a greater outflow from this area both to other parts of England and to other countries, so that it may be concluded that, on the whole, the changes which have occurred within the area are confined to the natives of the district.

The factors in the environment within which these people have lived may be considered under two heads: as static and as dynamic. It should be

remembered, however, that although the static elements, such as relief, climate, and rock-structure, are not constant but cumulative in their effect, yet they may be called static since they are always present, although their relative importance is always changing. The dynamic factors in the environment are due to human activities within the area during previous periods and without the area both during the period under consideration and during earlier years.

Static Factors in the Environment of the Population

Relief. The core of the district is that portion of the Southern Pennines which culminates in the Peak, 2088 feet, and which forms the northern portion of Derbyshire, with a minimum elevation of 1000 feet, above which detached portions rise to a height not exceeding 2000 feet (see Fig. 1). Southwards, long narrow valleys, Dovedale and Derwentdale, contain tributaries of the Trent. These valleys are justly famed for their scenery. A projection from the main uplands is continued eastwards to form the low hills of western Nottinghamshire, where the relics of Sherwood Forest make the Dukeries a district whose sylvan beauties attract many tourists. Usually, however, the uplands drop suddenly to the plains which stretch eastwards and westwards at a level lower than 300 feet, yet with a diversity of relief due to valley and knoll which gives considerable variety to the landscape. The eastern plain contains the tributaries of the Trent, and the western, the Cheshire Plain, is diversified by the streams which reach the Weaver, the Dee, and the Mersey. The whole area, therefore, presents the contrast of upland and plain, in which the difference in elevation is greater than that which is encountered elsewhere in England, except farther north.

Rock-Structure. The uplands of northern Derbyshire consist of Carboniferous limestone flanked on the east and northwest by narrow bands of millstone grit: these form the Lower Carboniferous rocks of Figure 2. Almost entirely along the western and quite along the eastern edge of these rocks lie the Coal Measures, and beyond these are the lower heights and the plains, where the rocks are chiefly Keuper marls and sandstones with specimens of Bunter sandstone in western Nottinghamshire and western Cheshire. The Robin Hood Hills of Nottinghamshire are a Bunter formation, but the knolls of Cheshire are Keuper sandstone. The scenic beauties of northern Derbyshire are due to the Carboniferous or mountain limestone, which accounts for the gorges of the Dove and Derwent. The sylvan glories of the lower hills, Sherwood Forest, and Delamere Forest in Cheshire are due to the sandstones. The mountain limestone yields ores of lead, zinc, and copper; the Keuper marl gives quantities of rock-salt.

Rainfall. In a small area such as this, with so small a variation in elevation, the chief climatic factor is the rainfall. It may be noted, however, as one of the causes of the difference in rainfall between the eastern and western plains that the eastern plain is several degrees colder during the winter

than the western plain, in consequence of the fact that the winter anticyclonic conditions tend to spread from the continent over Nottinghamshire more frequently than over Cheshire, and that therefore the winter months in the east tend to be drier.

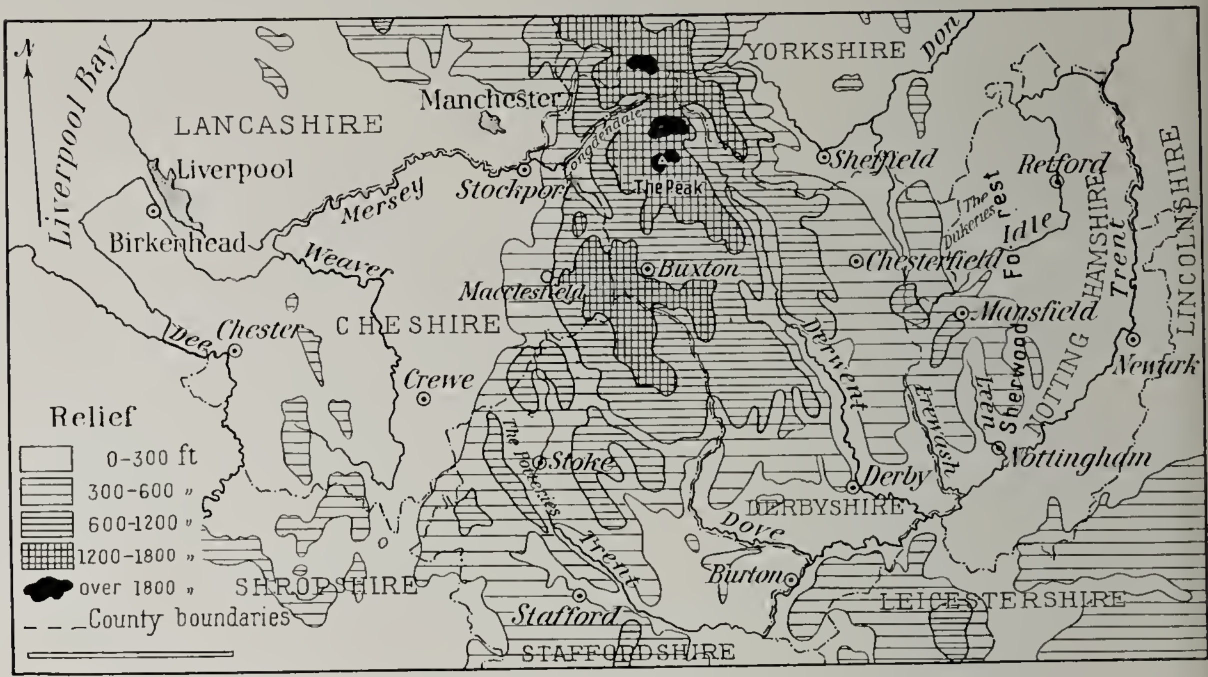

FIG. 1—The Southern Pennines: Relief.
Note. The line in the lower left corner of Figs. 1 to 3 represents a distance of 20 miles.

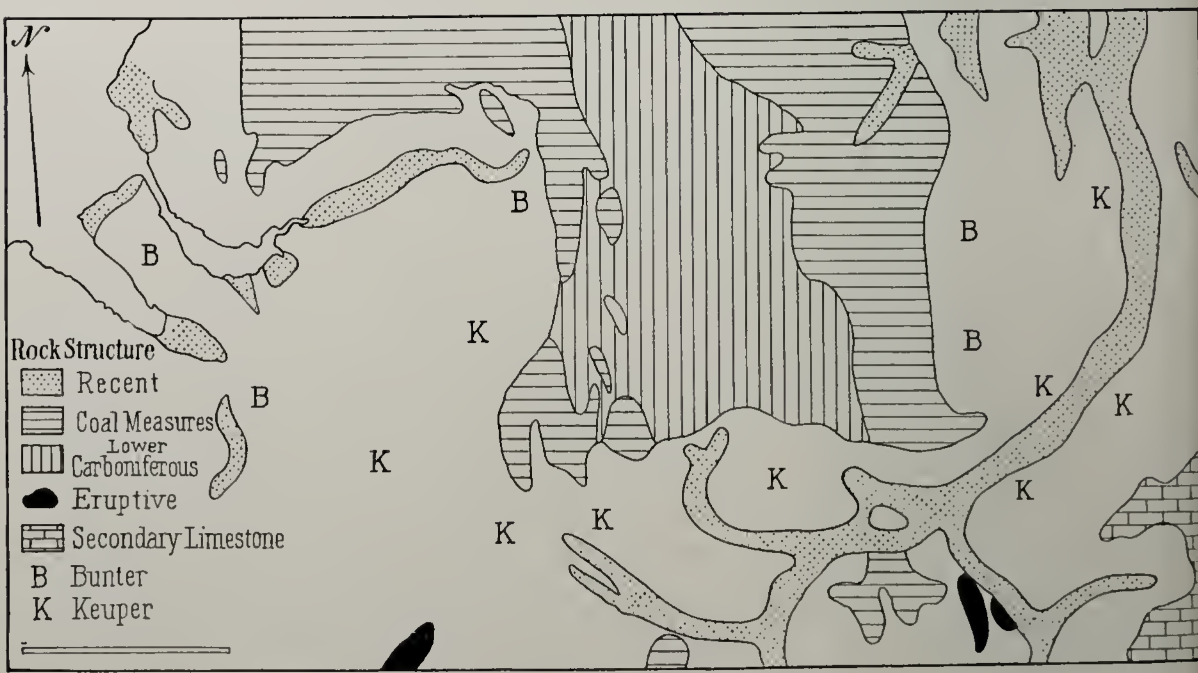

FIG. 2—The Southern Pennines: Rock-structure.

The distribution of the total annual precipitation is indicated in Figure 3, where it may be seen that the higher the land the heavier the total annual rainfall, while the eastern plains are drier than the western plains. The 30-inch isohyet on the east of the uplands tends to coincide with the 500-foot

contour, while on the west the 500-foot contour is close to the 40-inch isohyet.

But the most important fact regarding the rainfall of this district lies in the effect of the prevalent warm winter conditions upon the hills, especially upon their western slopes. During the winter the hills are very much wetter than the plains, and during the summer the plains are very much wetter than the hills; the word *wet* in this connection being used in a special sense with reference not to the total fall of rain but to the percentage of the total annual fall which occurs during the periods named. The hills have a large proportion of their rain in the winter, so that it appears probable that the excess rainfall upon the hills in comparison with that upon the plains is

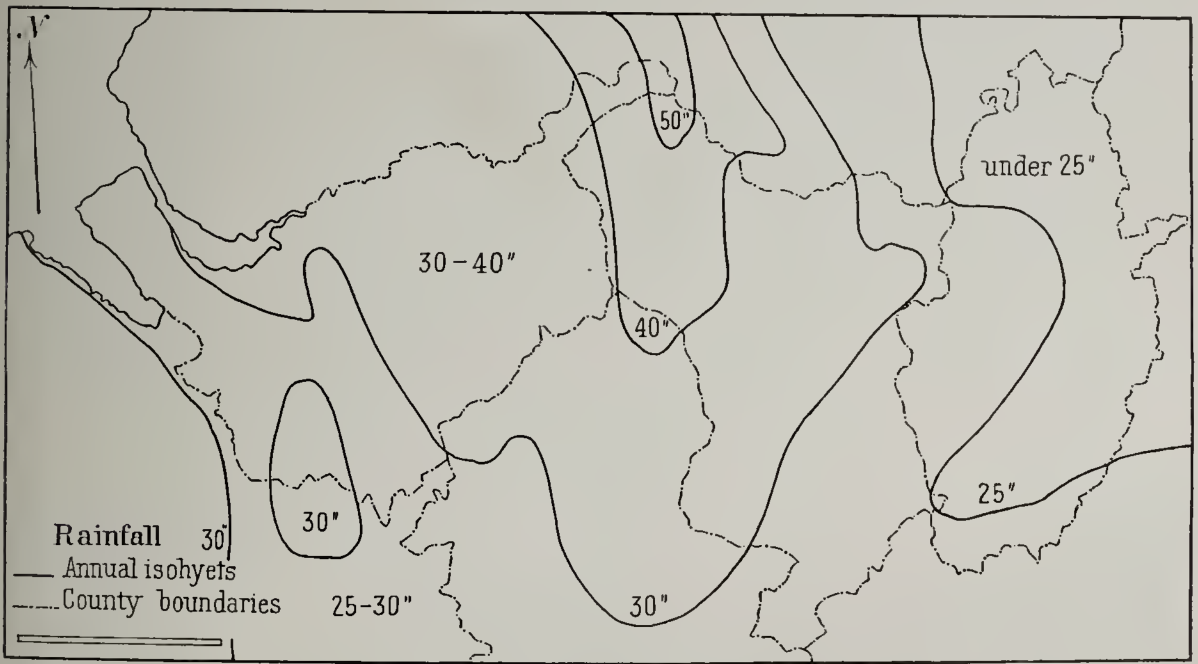

FIG. 3—The Southern Pennines: Rainfall.

due to an amount of precipitation during the winter which is superposed on the hills only during that season.

One other difference is of importance. In the Trent valley in Nottinghamshire there is a probability of specially heavy rain splashes during the months of June and July, with the inevitable consequence that the farm-land near the river is frequently flooded during the period when the crops are ripening. The total precipitation suffices for the hill streams, many of which have been, and some of which still are, used as sources of water power.

To some degree the Cheshire lowland shares in the noteworthy humidity of the atmosphere which is characteristic of the Lancashire plain farther to the north.[1] This humidity is of especial value in connection with those val-

[1] For a fuller examination of the rainfall conditions of the Southern Pennines in relation to the monthly variations in intensity, with particular reference to the areas where the cotton factories are most numerous, the reader may be referred to a paper by the writer on "The Rainfall of the Southern Pennines," published in the *Quart. Journ. of the Roy. Meteorolog. Soc.*, Vol. 40, 1914, pp. 311-322 (discussion, pp. 322-326).

leys, such as Longdendale, which open out facing the southwest; since the moist air is, as it were, forced into a steadily narrowing gap which increases the percentage of moisture in the air. In this respect Longdendale will necessarily have a more humid atmosphere than Derwentdale, which slowly opens out towards the southeast.

Changes in the Distribution of the Population

The accompanying maps (Figs. 4-6) which show the density of the population are based upon the Census reports of England. The areas which have been considered are the smallest administrative units, the parishes, and the three maps, here published, are typical of the manuscript maps

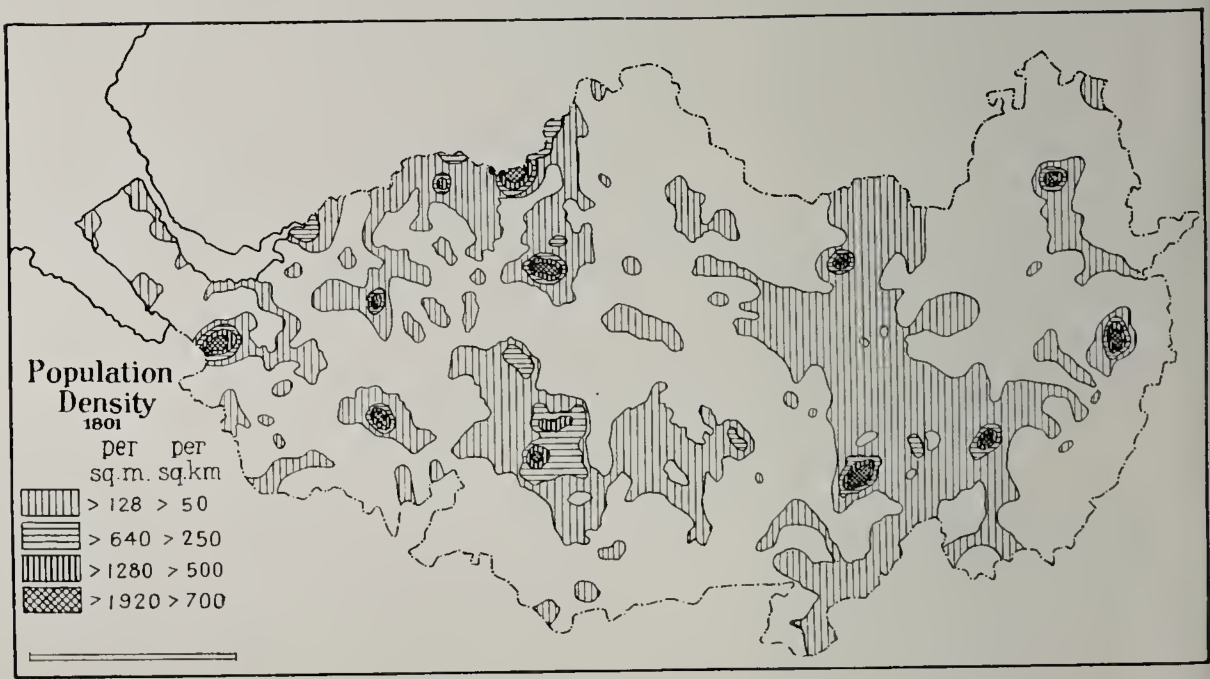

Fig. 4—Density of the population in 1801.
Note. The line in the lower left corner of Figs. 4 to 6 represents a distance of 20 miles.

which have been made for each of the eleven census years beginning at 1801 and ending with 1901. They present three stages in a gradual change, in some areas progressive and elsewhere retrogressive, which has been operative throughout the century.

The population lines which are drawn upon the maps embody the same principle as that which is utilized in the mapping of contours and of climatic lines such as isotherms. The density value for each parish was entered upon a map and the numbers so entered were treated in the same fashion as "spot heights" in the drawing of contours.[2]

In 1801, the district was relatively scantily peopled (Fig. 4). More than half the area contained fewer people than 128 per square mile. There were nuclei of people in the towns which are strung along the Trent valley,

[2] For a discussion of various methods of representing population values upon maps, the reader may be referred to a paper by the writer on "Distribution of Nationalities in Hungary," which was published in the *Geogr. Journ.* for March, 1916.

Stoke, Derby, Nottingham, Newark, and Retford. Along the south bank of the Mersey were Stockport, Altrincham, and Runcorn. The ancient town of Chester was a crowded place, and there were isolated urban areas at Nantwich, Northwich, Macclesfield, and Chesterfield. In most cases the

FIG. 5—Density of the population in 1851.

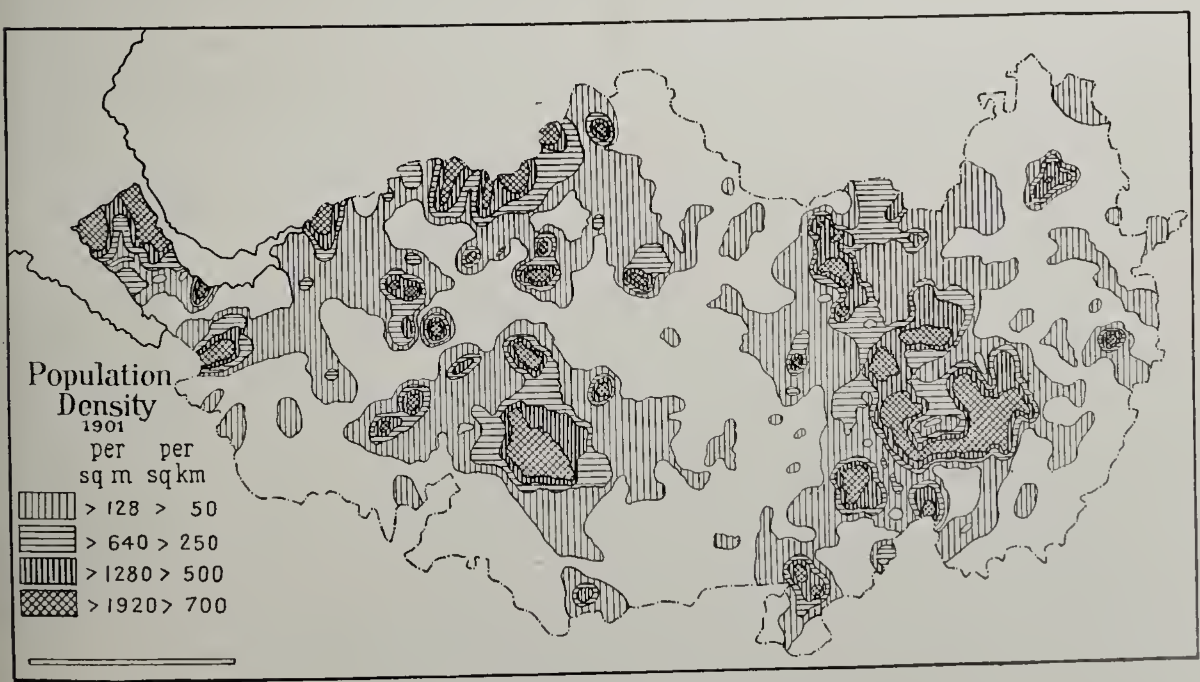

FIG. 6—Density of the population in 1901.

change from urban to rural proportions was rapid; the single exception was to be found in the Potteries round Stoke. The rural population tended to be most dense in certain definite directions, along the Trent valley, northwards along the Erewash valley, past Chesterfield in the direction of Shef-

field, towards the Potteries from Stockport through Macclesfield, and slightly away from the Mersey from Stockport towards Chester.

The distribution in 1851 (Fig. 5) resembled that of 1801 except that the areas of higher population had tended to spread and in some cases had coalesced. The Potteries area had grown to include Congleton, the Stockport area had spread eastwards to include Glossop in Longdendale, the Derby area had spread up the Derwent valley to include Belper, the Nottingham area had grown to include Ilkeston. Newark and Chester, towns of relatively great age, grew but little. Birkenhead had become important in consequence of the establishment of ferry communication across the Mersey estuary with Liverpool. The rural areas show little more than the natural increase of an agricultural population which remained attached to the villages. The map indicates that there had been relatively little migration from the rural to the urban areas, since the urban areas are still relatively small in comparison with the area of the whole district.

By the end of the century there had occurred great changes (Fig. 6). In the first place, the rural areas now contained, on the whole, fewer people than in 1801; there had been a migration out of the country districts which had exceeded in numbers the natural increase of the population during half a century; in some districts the population was sparser than in 1801. In those areas, every 100 persons in 1801 should have increased during the century to 300 at least, yet, in fact, they had decreased in some cases to about 75. The urban areas had grown denser and larger. The most striking urban increase occurred between Ilkeston and Chesterfield and both east and west from Stockport. Birkenhead had grown larger as a town of increased shipping with new docks and ship-yards and also as a dormitory for Liverpool. There had occurred a distinct shifting of the mass of the people; the decline in population in the area which occupies the center of the map is notable.

It may be well to try and picture a rural scene, such as has maintained almost an unchanged distribution of population during the century. A cluster of small houses nestles near the church, and farmyards are separated only by a brick wall from God's acre. Outwards, in all directions, the small fields with typically English hedgerows; here and there, dotted over a landscape with gentle undulations, an isolated farm. With a slight turn of the head the eye sweeps over an area of about fifty square miles, and if one counts the cottages and farms they will not number a hundred. Somewhere close by is a main road, often dating back like Watling Street or the Fosse Way to Roman times; centering on the tiny village are the minor roads. Nowadays the main roads are used by travelers who sweep along in speedy motors, the minor roads are traversed by farm wagons, by the carts of the butcher and the baker, or by vans which deliver commodities from the nearest large town. Such a scene is typical over the major portion of the country. There are subtle differences in Cheshire; trees line the fields,

and coppices and spinneys are more frequent; nearer the high ground, hedges give place to stone walls; in the east, ploughed land or growing crops take the place of the commoner pasture land in the west.

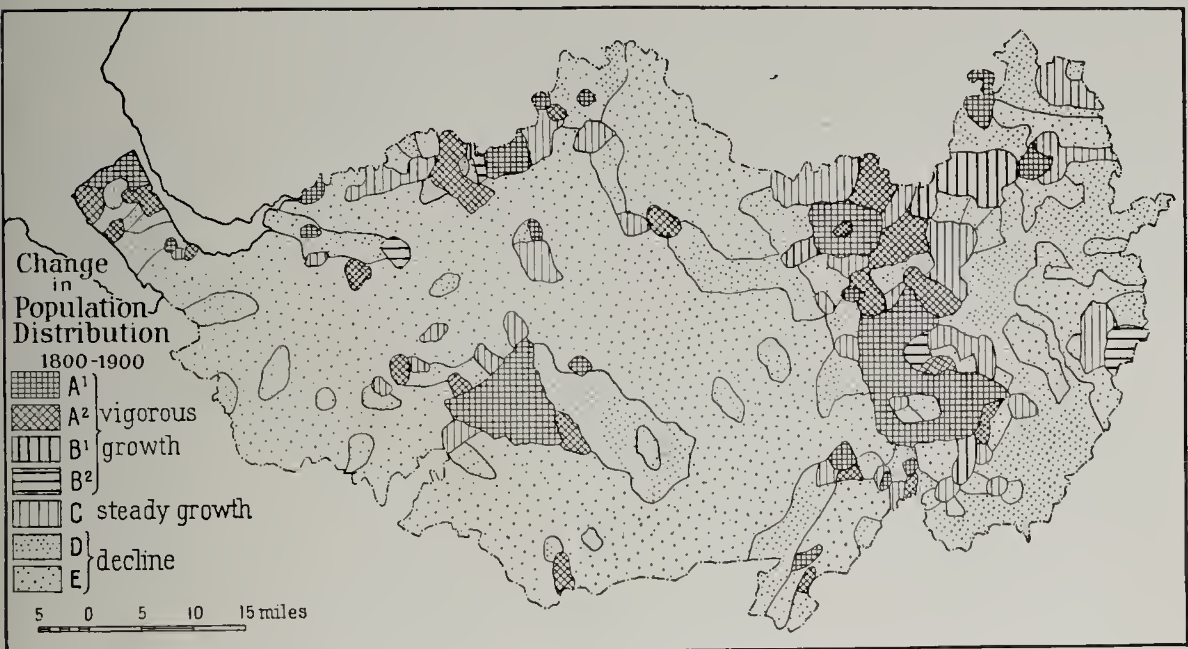

FIG. 7—Changes in the distribution of the population during the nineteenth century.

The changes which occurred during the century are summarized in Figure 7. The district is divided into five types, wherein the changes had occurred that are indicated by the graphs in Figure 8. In the areas of group C the rate of change of the population had been steady and equivalent to the average for England as a whole; the population had trebled itself. These parishes are scattered and small in total area. The people indicated in group D were proportionately as numerous in 1901 as in 1801; the areas so indicated had seen an increase in density during the first half century and an almost equal decline during the second half century. Such areas are particularly large in the county of Nottingham. The largest areas are those of group E, where the population had declined in numbers, especially since 1851.

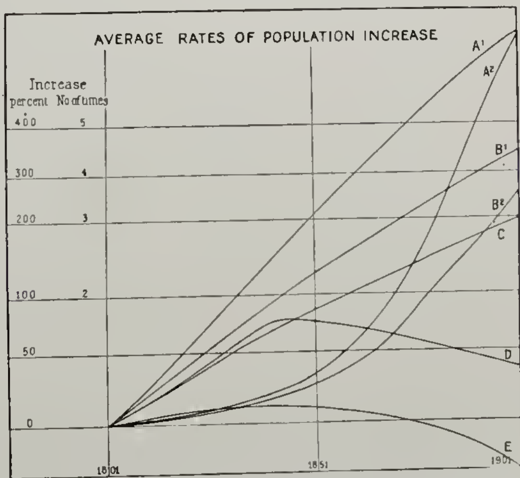

FIG. 8—Average rates of increase of the population. (The symbols correspond with those on Fig. 7; for their precise meaning, see the text.)

Groups A and B contain those parishes where the population had multiplied five and four times respectively; in some of the parishes (groups A^1 and B^1) the rate of increase had been steady and continuous throughout the century; in the others (groups A^2 and B^2) the growth occurred almost

entirely during the second fifty years. Figure 7 indicates the great importance of the district between Ilkeston and Chesterfield, the great growth of the compact area of the Potteries, the expansion of Stockport, and the rise of Birkenhead. Maximum progress of this type becomes evident to the traveler by the continuity of the brick buildings—houses and factories—which line the roads and tend to fill in the intervening spaces. It ends eventually in an amalgamation of townships such as the recent combination of Hanley, Stoke, Burslem, etc., into the single town of Stoke—the "Five Towns" of Mr. Arnold Bennett's novels. It is manifest by the difficulty which is experienced in determining where Stockport, say, ends and Hazelgrove begins.

The First Half-Century

The industrial revolution of the later years of the eighteenth century had given life in northern England a definite stimulus towards the growth

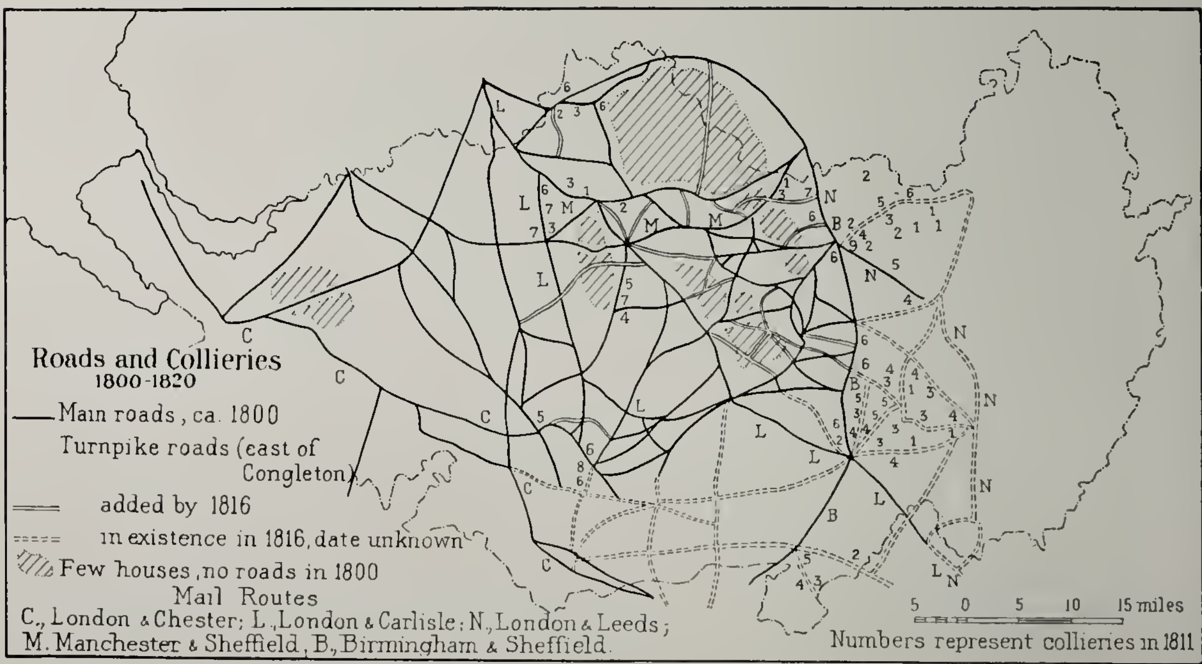

Fig. 9—Roads and collieries, 1800-1820 A.D.

of manufactures, and the first fifty years of the nineteenth century were, therefore, a period of experiment and adjustment.

Again and again factories were established, operated for some years, and finally closed as failures; these were typical experiments by which the northerner tested the possibilities of his environment. The needs of the increasing number of factory hands caused the farmers to alter gradually the basis of their agriculture, and the requirements of industry occasioned developments in transport, inventions of new machinery, a greater need for coal; and life within this area only gradually adjusted itself to these changing conditions. The old records are in many cases scanty, and those which are available are not of uniform excellence; it will suffice to specify two examples. In 1795, Dr. John Aikin published "A Description of the

Country from thirty to forty miles round Manchester" which is of surpassing importance on account of the valuable facts which are recorded and also because of the map which illustrated the text. During the first decade of the century the Board of Agriculture published reports upon the agriculture of the various counties, and of these Farey's account of Derbyshire excels the rest in consequence of its thoroughness and of its maps. Figures 9 and 10 are based largely upon these two sources of information, and they betray, at once, the lack of uniformity which exists in the old records. On this account it will probably be wise to consider the first half-century in general for the whole area and to devote attention during the second half-century to the major lines of development and decay. This plan has special merit, since the population as a rule progressed generally and uniformly during the period 1801-1851 (Figs. 4 and 5).

During these years the bulk of the population depended upon the land;

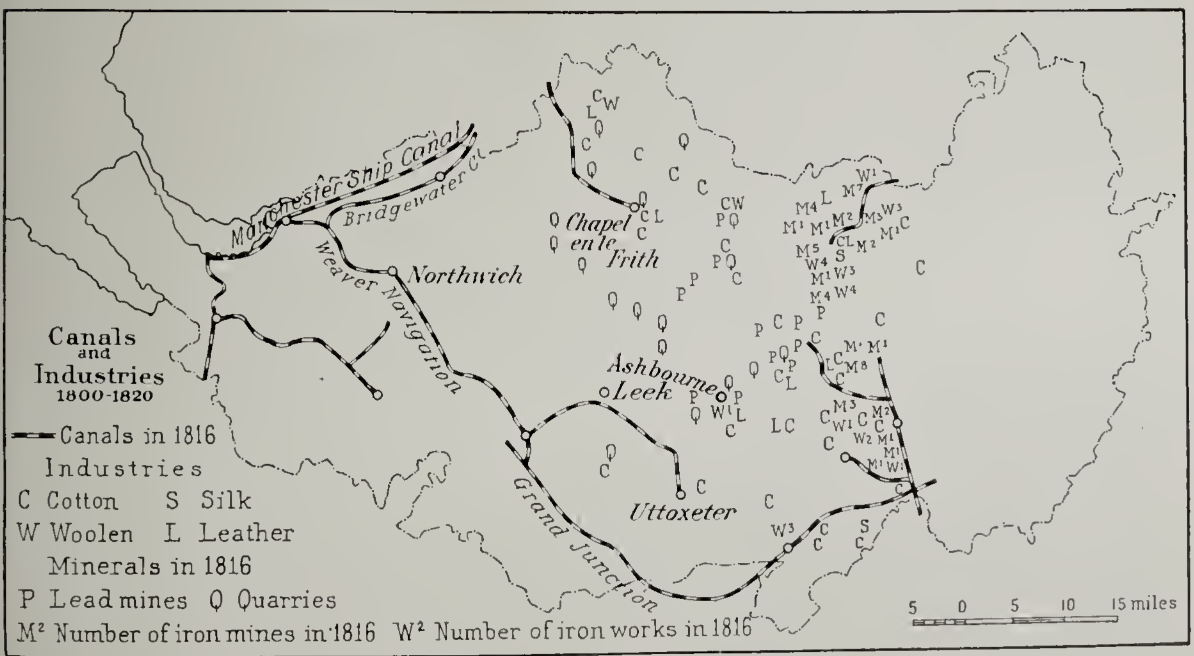

FIG. 10—Canals and industries, 1800-1820 A.D.

they were interested in the farms, which stretched over the whole of the area, except the limestone and gritstone moors of Derbyshire and the sandstone forested areas such as Delamere. (Figure 9 shows the patches with few houses and roads.) On the Cheshire side the view from the edge of a scarp such as that of Macclesfield lay over a countryside which presented the appearance of dense woods, but this appearance was deceptive, for there were few woods. The fields were small, they were bordered by hedgerows, with frequent and fairly large spinneys which were sufficiently numerous to give the impression of continuous woodland. On the uplands lay the stone-wall country where the farm-lands were bounded by stone walls instead of hedgerows. Southwards lay the flat lands of the Trent, which were continued eastward in more open farm-land with numerous meadows near the

river and the tributary streams. All the lowland farm-land contained a stiffish clayey soil, above the Keuper, lightened wherever the farmer had adopted the practice of marling, for the marl pits where the sub-stratum of the Keuper marl had been reached were common to many farms. In consequence of the greater rainfall of the west, pastures were more frequent in Cheshire and Staffordshire than in Nottinghamshire, with the result that oats and milk and cheese, with an increasing acreage under potatoes, characterized the western farms, while barley and wheat and flocks of sheep mark the drier eastern lands. Throughout Cheshire oats were ground into meal and formed the staff of life for the poorer people. Along the south side of the Mersey potatoes were grown and sent to Manchester and Liverpool for sale. Near Nantwich and along the upper Trent the manufacture of cheese was important during the early years; some was sent by sea from Chester and Frodsham to London and the rest was sent by road to Lancashire and Yorkshire. Agents visited the farms in Derbyshire in August and bought the cheese for the London market; most of it was transported by sea from the east coast port after a river journey down the Trent. With the advent of the railways the milk trade with the towns of southern Lancashire caused a decline in the production of cheese, but the pastures were still necessary for the store beasts which were brought into the district from the north and fattened for the butcher. The lower-class farmers rarely ate fresh meat, but the greater wealth of the factory operatives gradually led to a growing trade in meat. Dovedale was notable for its cattle. These facts kept the Cheshire farms small and intensified the need for farm laborers, which gave rise to the developments in the rural population shown in Figure 5. Intensive farming of this nature implies the use of manures, and lime was taken from the quarries at Chapel-en-le-Frith over the roads on the backs of small Welsh ponies for the farmers in Longdendale.

In Cheshire over 90 per cent of the land was farmed, and three-quarters of the farm-land was under grass. The spinneys provided oak bark and the cattle provided hides, so that Nantwich and Newcastle, for example, made shoes and leather bands for the machines of the factories. Before the days of railways milk was sent to the centers of population from the surrounding farms in barrels slung on the backs of asses or ponies. In Staffordshire two-thirds of the farms were under grass, and both in Staffordshire and western Derbyshire much barley was grown for the brewers at Burton.

The countryside, therefore, consisted largely of farm-land based upon the valley lowlands, crossed by the main roads, which were linked together by numerous dirt lanes. The cottages bordered the lanes, and the farm houses lay back among the fields. Only in the wealthier districts had the use of bricks and tiles begun to improve the appearance of the cottages, so that a contemporary writer could still describe a waterside village not

far from Chester as a "specimen of pure barbarism." Most of the main roads were in use for through traffic for the mail-coaches, and many of the purely agricultural townships such as Nantwich, Newark, and Retford owed much of their importance and wealth to the traffic which passed along the roads.

There were four areas notable for extractive industries. In the Weaver valley salt was obtained. The salt traffic had begun to concentrate upon Northwich and had affected Frodsham and Runcorn favorably. Some 50,000 tons per annum were exported to Ireland for curing provisions, and to Dunkirk, Ostend, Bruges, Riga, and Elsinore. This salt passed to Liverpool by the Weaver Navigation and thence as ballast in out-going ships. The evaporating pans were now made of wrought iron, and the coal necessary for fuel was supplied from Lancashire as a return cargo for the river boats.

Coal was mined east of the Pennines, in the Coal Measures which flank the upland continuously. Almost from Derby to Nottingham and in the north round Chesterfield collieries were numerous, and in this district ironstone was also largely obtained. On most of the upland between Macclesfield and Stockport and in Staffordshire near Cheadle and in Derbyshire south of Burton there were small groups of pits. Much of the coal was used locally, yet some was sent short distances by pack-pony and by canal from southern Derbyshire to Leicestershire, and from Chesterfield to the counties of Nottingham and Lincoln, by way of the river navigation which began at Bawtry on the Idle. In the mountain limestone were lead mines, which were, at that early date, much troubled by in-flowing water, which was removed by hand-, horse-, and steam pumps. At Wirksworth lead was smelted and sent to London via Bawtry.

Limestone was quarried at various places, while saw-mills for making paving stones were worked, by water wheels, at Bonsal and Cromford, and, by steam, at Mansfield and Wirksworth.

As early as 1811 it was noticed that the exhaustion of lead mines caused a decrease in the number of houses at Tideswell and Moneyash.

The district contains three centers of industry: the Potteries, the attenuated line of cotton factories which stretched from Stockport across to Derwentdale and down the valley to Belper, and the iron works of eastern Derbyshire, both north and south.

In regard to cotton factories it must be noted that the great work of Arkwright was carried out in Derbyshire; during the later years of the eighteenth century cotton spinning mills were built at Cromford by Arkwright, at Belper and Milpond by his associate, Strutt, while others were erected at Glossop; by the beginning of the nineteenth century there were 37 mills in Derbyshire. In 1788, out of 123 water-mills engaged in the cotton trade in England, 22 were in Derbyshire, 8 in Cheshire, and 7 in Staffordshire. The driving force being water-power, the mills were situ-

ated up the valleys of Longdendale and Derwentdale; the first application of steam power to these mills consisted in the use of steam pumps to supply water for overshot water-wheels. Hand knitting of stockings was a common domestic industry, especially in the district between Derby and Nottingham. The invention of a rib machine caused a gradual localization of the stocking industry in factories situated in this district, of which Nottingham became the chief center. At Stockport, Aikin notes 23 cotton factories, four of which had steam engines. The combined use of water and steam for power lasted well into the century, for at Quarry Bank near Stockport a mill was built in 1877, partly driven by water. This mill, like others which had previously been in operation at Wilmslow in the neighborhood, failed. Farther south, near Macclesfield, the early mills based upon water-power one by one ceased work as the century grew older.

In Longdendale the cotton mills steadily increased in number; by 1820 at least 50 were hives of industry in the Glossop district, and these formed half the total number at work in Derbyshire. The factories were not limited to the spinning of cotton, since calico, muslin, and cambric were woven and there were four factories each engaged in calico printing, bleaching, and dyeing. In Staffordshire there were mills about 1820 at Rocester and Burton. Aikin notes that just before the century opened about 23,000,000 pounds of cotton were imported, about two-thirds of which came from the West Indies, and about half of which was used in the manufacture of calico and muslin, and that the total value of cotton goods made was about eight millions sterling. From other sources it may be estimated that the average imports of cotton in 1800, 1810, and thence by decades to 1850 were respectively, in million pounds, 50, 100, 140, 250, 500, and 725. This development coincided with the introduction of steam power, the development of the coal fields, the use of railways, and a great concentration of the cotton mills towards the towns, in which they are most numerous at the present time.

The Potteries were a collection of villages which lay roughly along the outcrop of quick-burning coals and clays suitable for the manufacture of earthenware. The district and the staple industry had already received a stimulus from the work of Wedgewood, but was handicapped by difficulties of transport, since the roads were bad and the pots had to be carried on the backs of pack mules for many miles. Newcastle, a residential town where boots and shoes were made, lay to the west of the Potteries, which centered upon Burslem, Hanley, Stoke—where the first steam engine had been set up by Spode to grind burned flint for the use of the potters—Etruria, Longport, Lane End (later called Longton), Cobridge, and Shelton.

In connection with the manufacture of iron goods Derbyshire in 1806 was the fourth county in importance in the United Kingdom. There were, in all, 18 furnaces with an annual production of 10,000 tons of pig iron.

Twelve furnaces were in blast and each had approximately the same annual output.

The first half century is notable on account of the changes which occurred in regard to transportation. When the century opened the canal era was in full swing, and it is important to note that the canals shown in the map, Figure 10, are the same canal routes which have been recommended as the most suitable for a great modern development of the canals of England. The Bridgewater Canal, the pioneer, traverses Cheshire south of the Mersey and was the precursor of the Manchester Ship Canal. There was a daily service of passenger boats along this canal from Manchester to Runcorn, which town had been rescued from oblivion by the canal, so that it gradually developed a chemical industry. Brindley, its famous engineer, had also helped in the construction of the Chesterfield Canal, which was to supersede the old river route via Bawtry. The needs of Cromford had led to the construction of the canal to join the Erewash Canal, which connected the collieries of eastern Derbyshire with a market in Leicestershire. The disabilities of the Potteries and the salt towns had led to the construction of the Grand Junction waterway with the aid of the Weaver Navigation to join Stoke with the Mersey estuary and also with the collieries of southern Staffordshire. China clay from Cornwall was brought to the Mersey and sent by canal to Stoke, coal was brought northwards. These canals embodied the principle of the maintenance of a water level, and the Erewash Canal winds inconveniently along by the side of the river along the 100-foot contour, except where it crosses the mouth of tributary streams over an embankment; the Peak Forest Canal was noted for its aqueduct at Marple Dale, 93 feet in height and 309 feet long, reputed to be one of the largest in England. The utility of the canals may be estimated from the following charges for the conveyance of a ton of goods from Liverpool to Manchester: by road, 40 shillings; by the canalized river Mersey, 12 shillings; by the Bridgewater Canal, 6 shillings. By the canal a 50-ton boat performed three trips a fortnight, while by the river three trips occupied a month. From Liverpool to Etruria the charge per ton by road was 50 shillings, by canal but 13 shillings 4 pence; freights from Manchester to Derby and Nottingham were halved.

Closely connected with the canals progress occurred in shipping in the Mersey and affected Birkenhead, which was a thinly peopled agricultural district in 1801. Between 1801 and 1820 sailing ships were still in use, and it is recorded that on one occasion a vessel which got out of the estuary before the wind changed sailed to Barbados and back before the other vessels for the West Indies were able to leave harbor. Even so late as 1834 the great spring fleet of 133 ships was held up in the estuary for six weeks by contrary winds, in company with other ships, so that when the wind was favorable 400 vessels departed in one day. The rise of Birkenhead is associated with two factors, first the establishment of steam ferries

to Liverpool in 1828 and secondly the establishment of Laird's shipbuilding yards in 1824 and the docks in 1843. Laird's built the first iron vessel in England in 1829, and, later, the famous *Alabama*. The introduction in 1837 of steamships from the Mersey to the United States reduced the time of the voyage from 28 to 10 days. In 1845 screw steam vessels came into use.

During the early years the roads were of great use, especially for through traffic, and it is noticeable that the majority of the main roads connect cities to the north with London or other cities to the south. For example, the Great North Road passes through the district from Newark to Retford, and its importance was so great that the mails for Nottingham were sent westwards from Newark. The great western road—Watling Street—

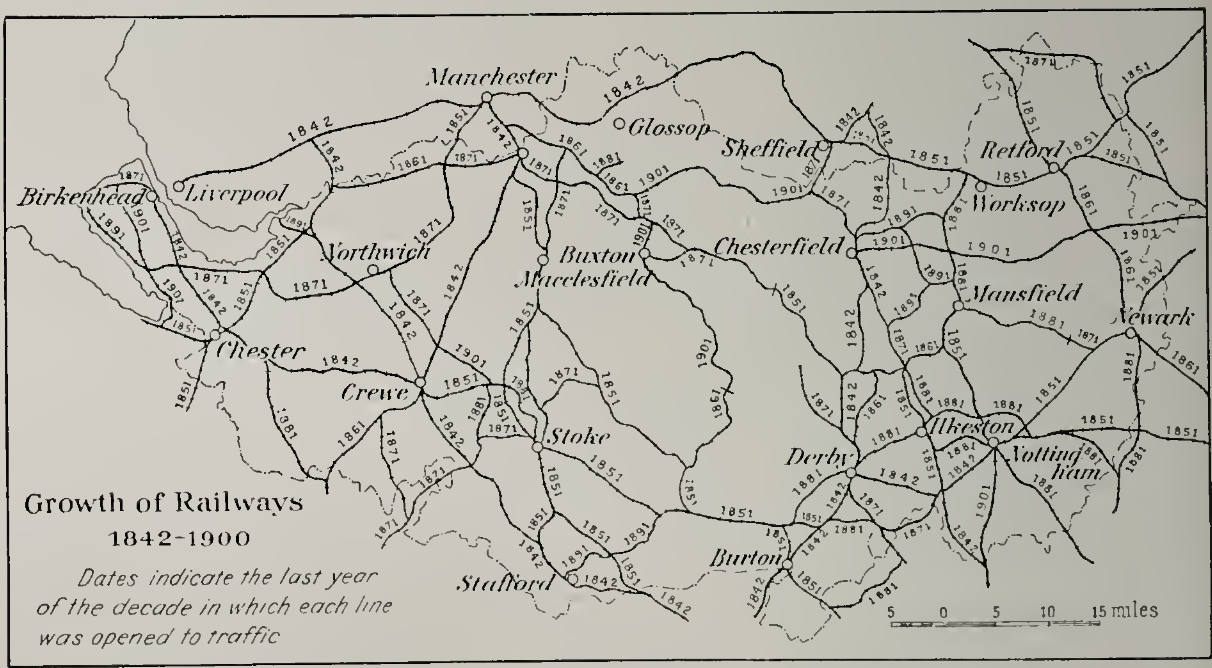

FIG. 11—The growth of railways during the nineteenth century.

passed through Staffordshire and Cheshire and maintained the prosperity of Nantwich and Cheshire during these early years.

The railways date from the first English railway, that between Manchester and Liverpool, opened in 1830. During the decade which followed this date the Midland Counties and the North Midland line were inaugurated, largely for the purpose of providing transport for the coal of eastern Derbyshire. These lines, which were later the basis of the Midland Railway, one of the chief English lines, were planned in a small inn situated in the heart of the colliery district, and in consequence the headquarters of the Midland Railway have remained at Derby. By 1841 the "West Coast" route from Scotland, which traverses the area and centers on the great railway junction at Crewe, was complete from London to Preston, and the "East Coast" route took its original track through the coal fields of eastern Derbyshire from York to the metropolis. The map, Figure 11, shows that by 1851, in addition to these two great cross-routes, connecting links had been established which gave a route from Birkenhead through Stoke, Derby,

and Nottingham to Newark, and from Chester through Manchester, Glossop, and Sheffield to Retford. By this time the lowlands were comparatively well served with railways.

The Second Half-Century

During the period 1851-1901 life in England, perhaps more than anywhere else in the world, underwent a great change of outlook; parochial affairs ceased to have much importance; the Englishman, willy-nilly, acquired some interest in the wide world, for his very existence depended upon circumstances which arose beyond the seas and which affected his existence more and more completely, as railways and steamships, telegraphs and cables achieved success and made the commercial world relatively smaller and more compact. A multitude of influences were at work, and it will not be possible to do more than indicate some of the major forces which affected the people of the Southern Pennines.

The Farmer and His Environment. By the courtesy of the Board of Education it has been possible to obtain from their records the facts which are tabulated below. Groups of contiguous parishes were selected upon the basis of rock-structure and the facts referring to the farm-work of these parishes are indicated in the tables, while the facts regarding the population are shown in Figure 12. Considering the diagram first, it becomes obvious that the farming population has steadily declined since 1851, while it steadily rose during the earlier fifty years: the slope of the curves in Figure 12 indicates that the rate of regression was on the whole slower than the rate of progress; this general feature is exemplified for all the farming districts by the areas labeled D and E in Figures 7 and 8.

Turning now to the tables, we see that the greater portions of the selected districts were under cultivation; the influence of the rainfall is clearly shown, however, since the wetter west contains about 50 per cent more grass than the drier east. Rainfall has a greater effect in this connection than either elevation or rock-structure. Two-thirds of the arable lands was usually under cereals, wheat, oats, and barley, and this proportion remained fairly constant despite (1) a decreased arable acreage, (2) changes in the proportion of wheat in comparison with oats. Barley was only grown in the east, and, whenever it was grown extensively, it maintained its proportion to the total arable area. Wheat gradually declined in importance; about 1870, rainfall and rock-structure had little influence in determining the area under wheat, but with the decline it became obvious that wheat cultivation on the Bunter sandstone was less satisfactory than upon the Keuper, so that the farmer responded to the effects of world competition by cutting down his wheat acreage and by maintaining wheat only where most successfully cultivated,—on the stiffer soils of the Keuper. The effect of the heavier rainfall on the west, the cooler temperatures of the hills and of the displacement of wheat is shown by the

general increase in the importance of oats, which are affected by two other local facts: (1) the need of fodder for the increased number of horses in the factory areas and (2) the use of oat straw for packing pottery wares. The trade in milk to the factory towns, the manufacture of cheese, and the preponderance of grass are all connected with the proportionately large numbers of cattle in Cheshire in comparison with Nottinghamshire; the Keuper marl usually carries more cattle than the Bunter sandstone. The mountain limestone carries sheep well, but the sheep area of greatest value is the Bunter sandstone of the drier east; and where there are many sheep there are many fields of turnips. The noticeable changes which occurred from 1870 to 1901 indicate the effects which world progress—a dynamic factor—produced upon the life of the farmer. The distinguished agriculturist, Mr. A. D. Hall, in "A Pilgrimage of British Farming," comments upon the intensive farming of small holdings from 30 to 200 acres in Cheshire; "the main-stay of Cheshire farming is milk production." The Cheshire farmer usually has two years of oats, one of potatoes and other roots, and one of seeds every four years. In Derbyshire, on the mountain limestone, in the stone-wall country, he found the farms small, about 50 acres, and dependent on milk which is sold to cheese makers, as southern Derbyshire is the home of the Stilton cheese.

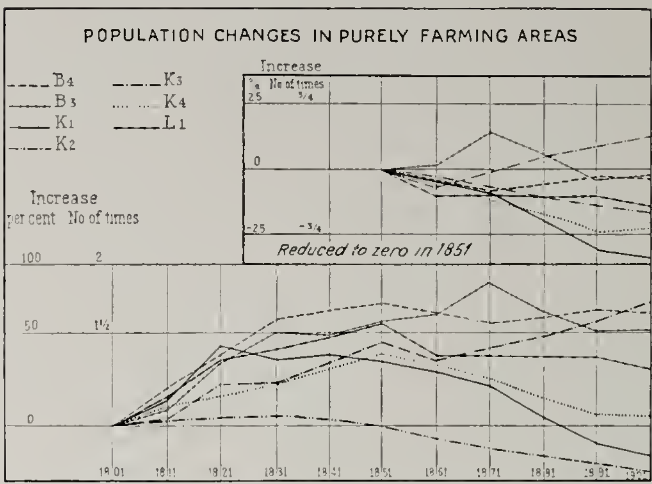

FIG. 12—Variations in the population in purely farming areas. (For key to symbols, see footnote to table opposite.)

The result of the changes for the farmer during the nineteenth century may be, therefore, summarized. For approximately seventy years the farmer worked for local needs in accordance with his opportunities; he sold barley to brewers at Burton, oat straw to the potters, milk to nearby growing towns, some cheese to factors for the London market; he grew wheat and potatoes for the population of the neighborhood. Since 1870 he has grown less wheat, since England has steadily bought more and more wheat abroad, and he has steadily settled down in the west to produce milk and cheese for the factory workers. In the drier east he has retained his interest in sheep on the sandstone country and in cattle and wheat on the marls and clays. Throughout the area he has declined in numbers, and the farther he was removed from the towns the more rapidly have his numbers declined. Over and over again it is recorded that the rural population had migrated to the factories; the frequency of small farms indicates the dearth of agricultural laborers; usually the farm is worked by one or two men.

TABLE SHOWING THE RELATION BETWEEN AGRICULTURE AND ROCK-STRUCTURE

Group*	I. Area of cultivated land: per cent of total area				II. Area of grass (permanent and rotation): per cent of I				III. Area under wheat [a]			
	1870	1881	1891	1901	1870	1881	1891	1901	1870	1881	1891	1901
B^1	77	86	84	80	36	43	50	46	18	13	5	7
B^2	73	89	87	87	57	66	66	63	27	23	21	20
B^3	78	81	81	81	78	85	90	91	32	23	12	8
B^4	88	99	97	98	34	36	43	43	36	28	22	12
K^1	86	94	91	92	78	82	86	89	35	31	26	28
K^2	89	86	91	94	53	57	59	60	26	29	28	23
K^3	63	60	82	81	71	70	75	73	24	17	10	9
K^4	62	69	71	71	46	50	54	57	34	28	31	24
S^1	89	87	90	88	82	88	90	92	19	21	20	8
S^2	85	85	82	80	62	68	72	75	38	34	30	25
S^3	91	93	88	92	70	73	80	81	32	32	32	32
L^1	84	90	87	90	88	92	94	93	1	2	..	..
L^2	30	41	40	39	94	96	98	98	14	8	..	3
L^3	79	78	79	78	44	51	55	58	26	21	24	18

Group*	IV. Area under barley [a]				V. Area under oats [a]				VI. Area under turnips [a]			
	1870	1881	1891	1901	1870	1881	1891	1901	1870	1881	1891	1901
B^1	23	21	21	23	17	25	34	35	32	32	30	29
B^2	6	3	6	5	30	35	36	36	12	13	14	11
B^3	7	4	1	2	33	45	57	68	8	11	13	13
B^4	23	22	24	23	4	9	17	22	24	27	26	27
K^1	5	11	3	5	25	26	31	31	6	8	14	14
K^2	22	27	25	26	4	6	6	14	13	15	20	19
K^3	1	..	1	1	42	44	52	56	9	7	7	8
K^4	18	22	17	22	4	9	10	10	10	10	10	12
S^1	9	4	3	1	35	42	37	46	12	13	13	7
S^2	9	8	6	7	22	27	34	39	12	15	17	17
S^3	17	13	10	6	17	23	31	28	9	12	15	14
L^1	..	..	..	..	65	69	54	67	17	13	23	16
L^2	2	..	2	4	52	53	54	48	11	8	14	12
L^3	25	26	25	25	12	15	17	23	21	22	20	20

Group*	VII. Total of III, IV, and V Cereals				VIII. Numbers of cattle per 1,000 acres of grass of both kinds				IX. Numbers of sheep per 1,000 acres of grass of both kinds			
	1870	1881	1891	1901	1870	1881	1891	1901	1870	1881	1891	1901
B^1	58	59	60	65	176	167	157	145	2,390	2,500	2,090	1,390
B^2	63	61	63	61	368	268	255	248	730	555	1,015	350
B^3	62	72	70	78	406	378	521	521	440	76	263	130
B^4	63	59	63	57	276	286	293	249	1,740	1,680	1,830	1,740
K^1	65	68	60	64	410	410	450	420	510	100	420	270
K^2	52	62	59	63	407	450	431	415	875	425	595	440
K^3	67	61	63	66	650	458	320	335	357	113	180	300
K^4	56	59	58	56	456	405	425	390	1,080	416	394	440
S^1	63	67	60	55	350	329	397	365	502	250	414	315
S^2	69	69	70	71	280	254	292	260	591	315	362	311
S^3	66	68	73	66	365	295	320	270	528	110	425	243
L^1	66	71	54	67	280	255	280	282	1,020	895	715	450
L^2	68	61	56	55	350	301	301	296	805	720	800	785
L^3	63	62	66	66	322	291	326	284	1,130	670	630	430

* *Key to Groups of Parishes.*

B^1=Bunter highlands in Nottinghamshire.
B^2= " lowlands in Wirral Peninsula.
B^3= " " " southwestern Cheshire.
B^4= " " " Nottinghamshire.
K^1=Keuper marl near Derby.
K^2= " " " Nottingham.
K^3= " " " Knutsford (area before 1881 different from that after 1881.)
K^4=Keuper marl near Retford.
S^1=Coal Measures near Cheadle.
S^2= " " " Chesterfield.
S^3= " " " Ilkeston.
L^1=Mountain limestone, highland, near Bakewell.
L^2=Carboniferous rocks, highland, near the Peak.
L^3=Permian limestone in Nottinghamshire.

[a] Per cent of arable area less area of rotation grass.

The Miners: Failure and Success. Mention has already been made of the lead mining which occurs in the mountain limestone, especially in the neighborhood of the middle Derwent. This industry is a comparative failure. Figure 13 indicates how the failure of lead mine after lead mine contributed to the decline in population which is characteristic of northern Derbyshire. This failure is due to two forces; the first, dynamic, is connected with the more efficient lead mines which have been operated in other parts of the world, and the second, static, is connected with the difficulties of working the mines, owing to the water which percolates through the limestone. In 1873 Britain produced 74,000 tons of lead ore; this output had dwindled to 28,000 tons in 1901. In that year Derbyshire produced 3,000 tons, about a fourth of the total output of England.

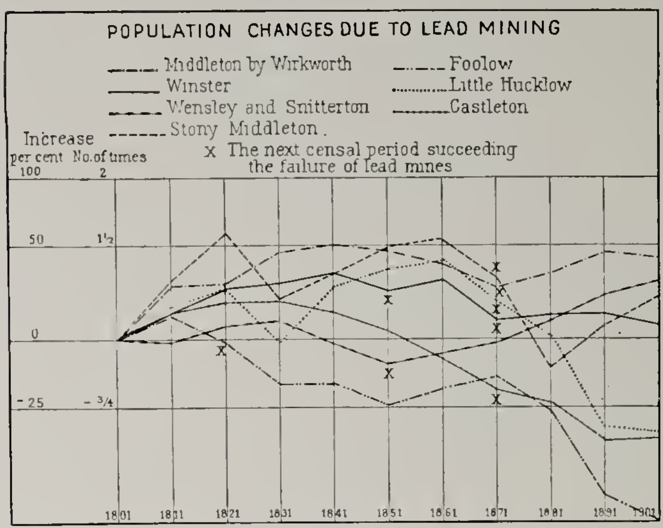

FIG. 13—Population changes due to lead mining.

In 1882, the four chief lead mines were at Great Hucklow, Haddon, Crich, and Wirksworth, and in these about half the total output of the county was obtained. No other mine yielded as much as seventy tons per annum, and thirty smaller mines are specified in the mining records as yielding less than ten tons each annually. By 1901 the decline had been so general that only twelve mines could be specified from each of which the annual yield amounted to at least five tons.

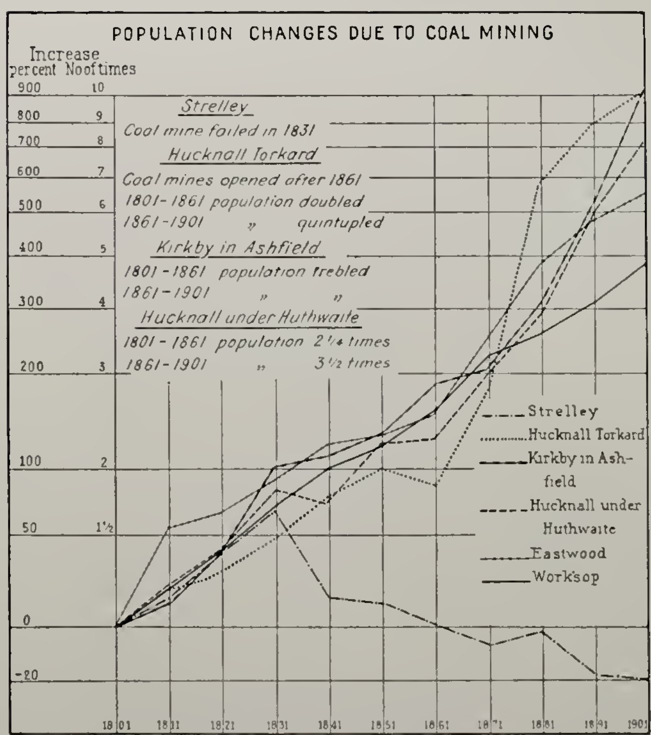

FIG. 14—Population changes due to coal mining.

Salt mining is localized in the Weaver Valley, where the progress in population has been, on the whole, normal. This district yielded 56,000 tons of rock salt in 1901, which was just over half the total production of England. The British production of salt has been approximately steady since 1881 at 2,000,000 tons annually.

In tune with the prevalent tendency towards industrial concentration the salt mines have ceased in outlying places such as Nantwich, and the chief centers since 1882 have been Northwich and Malpas. Salt mining has affected the population chiefly by the growth of the dependent industry of chemical manufacture and has caused the growth of Northwich and Runcorn, as well as neighboring towns north of the Mersey, as definitely urban factory towns.

The chief mines are the collieries. The coal mines were important before 1851, but their relative importance has steadily increased since that date, so that the colliery areas are usually indicated by so great a growth of the population that it increased from sixfold to tenfold during the century (Fig. 14). In Nottinghamshire the pits have gradually extended eastwards, but near Macclesfield they have declined. The following table indicates the number of pits in operation at the dates named, and it may be remarked that a pit in 1901 was a vastly more productive place than in 1811.

NUMBER OF COLLIERIES IN OPERATION

CHIEF TOWN IN DISTRICT	APPROXIMATE AREA OF DISTRICT IN SQUARE MILES	NUMBER OF PITS IN:—						
		1811	1854	1861	1871	1881	1891	1901
Stockport	60	29	19	26	27	35	19	24
Macclesfield	30	40	14	19	10	6	3	4
Stoke	80	25	123	128	111	144	146	122
Burton	30	14	7	11	10	16	23	18
Ilkeston	40	17	7	12	14	23	20	23
Ripley	40	19	11	14	13	17	20	19
Alfreton	80	28	21	23	22	31	19	28
Chesterfield	100	69	71	60	45	109	98	89
Nottingham	*	20	17	20	29	40	52	61

* Continually increasing, as pits were sunk through the Permian limestone and the Bunter sandstone to the east of the Coal Measures.

The table clearly indicates great progress everywhere except in the Macclesfield district; and this fact is emphasized by the next table, which shows that the output in Cheshire is small and declining while that of Nottinghamshire especially shows a remarkable increase.

COAL PRODUCTION AND PEOPLE EMPLOYED

COUNTY	COAL PRODUCED IN MILLION TONS				NUMBER OF MINES		PEOPLE EMPLOYED IN THOUSANDS		
							TOTAL	1901	
	1854	1882	1891	1901	1854	1901	1854	ABOVE GROUND	BELOW GROUND
Nottinghamshire	0.8	5.0	7.2	8.2	17	61	3.7	5.6	22.2
Derbyshire	2.4	8.4	11.0	14.9	117	177	5.4	10.0	39.9
Cheshire	0.8	0.8	0.7	0.6	33	28	2.6	0.6	2.2
North Staffordshire	...	4.9	5.1	(a)	123	122	(a)	(a)	(a)

(a) All Staffordshire in 1901, 13.1 million tons, 351 mines, 11.9 and 37.2 thousands of people above and below ground respectively; 25.7 thousands all told in 1854.

The change in value of each pit is important; for example, in 1854, there were in Nottinghamshire 17 pits with, on the average, 220 persons

employed at each, while in 1901 there were 61 pits with 450 employees each.

The coal miners form one of the chief elements in the populations of the districts labeled A[1] and A[2] in Figure 7; in fact, the distinction between the areas A[1] and A[2] is almost entirely due, in the County of Nottingham, to the fact that the pits were only opened in the Leen Valley (A[2]) during the second half-century (Hucknall Torkard, Fig. 14).

These three minerals, lead, salt, and coal, are typical of three forms of population change (coal—great progress, above the normal; salt—normal development; lead—regression), and they exemplify how dynamic factors such as railway development, growth of nearby markets, the invention and use of steam engines, the need for new products such as bleaching powder override the purely passive factors such as rock-structure in utterly changing the lives of men. The Leen Valley shows this overpowering influence with great prominence. The traveler journeys southwards through Sherwood Forest. He is surrounded by sylvan glories, a wealth of gorse, dainty silver birches in clumps, and groups of majestic beeches. Suddenly he halts at the head of a valley. In the foreground the valley sides are cultivated and there is peaceful farm-land; the background is obscured by the rolling clouds of smoke from the pit heads in the middle distance. He reaches the collieries by a devious route, for there is no road which leads direct from the forest to the mine. He is in a narrow valley in which flows a tiny stream; the lowland is completely filled by railway tracks; three different railway companies have built their roads now side by side, now interlaced, again one crossing the others obliquely, and beside the tracks are the pit heads with their tall chimneys and winding wheels in alternation. Each pit steadily encroaches on the farm-land, which yields reluctantly; the rubbish from the mine lies in long hillocks which smoke from the combustion within, and crops grow within a yard or two of these unsightly mounds. The last years of the century saw a smiling farming valley become the busy home of thousand of miners.

Workers in the Coal-Fields. The beginnings of the manufacture of iron goods have previously been noted. The following table indicates the progress which was made during the second half-century in the areas indicated in Figure 10. The iron furnaces fluctuate in number considerably, but there is a steady increase in the average output per furnace during the period reviewed.

Pig-iron Production

District	Number of blast furnaces				Total production in 1,000 tons			
	1861	1871	1882	1901	1861	1871	1882	1901
East Derbyshire	24	38	40	30	130	270	373	450
North Staffordshire	24	31	25	14	188	268	276	200

It is impossible to distinguish the effect of the iron works from that of the collieries in so far as they jointly affected the population in their neighborhood. A typical area for the dual industry centers on Ilkeston; the outlook is dreary in the extreme. To stand in Nottinghamshire, above the left bank of the Erewash, and see below you first the canal swung across the mouth of a side valley by a dirty brick viaduct, beyond the canal the dull and dirty river, the land between you and the stream a desolate waste, above which rises a dull dingy building on which the brightest spot is the escaping steam, and the far side of the valley thick with small brick and slate houses above the roofs of which project the larger gaunter buildings of iron works and factories, and over all a pall of smoke—is to view a dismal scene where there is no green of vegetation and the few trees stand gaunt and skeleton-like memorials to man's conquest of his environment. Mid-summer rain is falling, yet no amount of water could apparently make the district fresh and clean.

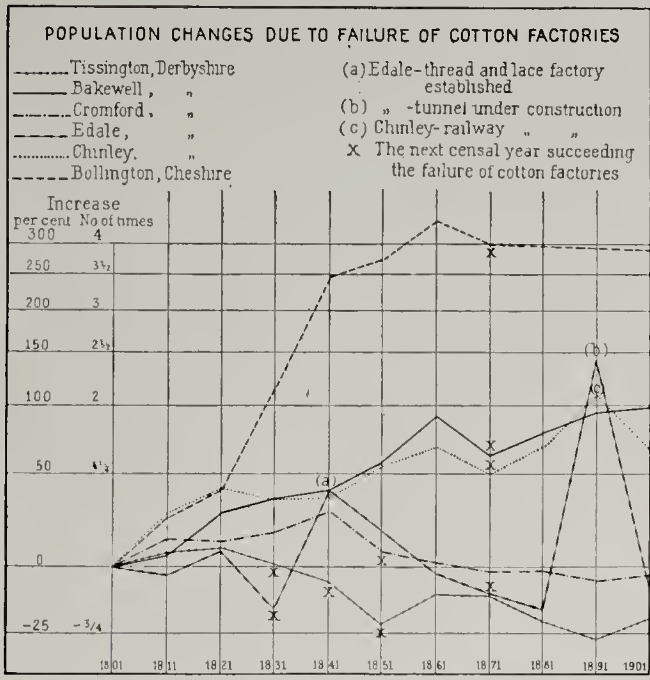

FIG. 15—Population changes due to failure of cotton factories.

During the early years of water power and experimental steam power cotton factories lay somewhat scattered along a line from Manchester past Stockport to Derby and Nottingham. Yet even the factories tended to concentrate; Figure 15 indicates the results of this tendency. Normally the cotton factories caused the population to increase at least fivefold, but in the cases shown in Figure 15 progress was changed to decline when the absence of coal and the difficulties of climate or transport caused the factories to fail. The cotton workers, therefore, are largely concentrated between Stockport and Glossop in the north and between Derby and Nottingham in the south, where maximum concentration of workers gradually occurred. The southern area is unsuited by climate for variety of cotton goods and specializes in hosiery and lace and contains 30 per cent and 70 per cent of Britain's makers in these commodities respectively. By inertia some cotton factories still linger in the Derwent Valley, but an owner remarks that he can only spin the coarser counts of cotton thread by surrounding his factory with canals, so great is his climatic disadvantage. The Stockport district strictly belongs to the cotton district of southeastern Lancashire; its relative importance may be gaged from the fact that it contains but 8 per cent of Britain's workers in cotton, while in the immedi-

ate district beyond the Mersey the cotton operatives are almost ten times as numerous. Striking evidence of the effect of cotton on the population is afforded by Figures 16 and 17, which are maps of Longdendale and its neighborhood. Figure 16 is based upon Doctor Aikin's map (about 1795), and Figure 17 is based upon a modern map made a century later. Doctor

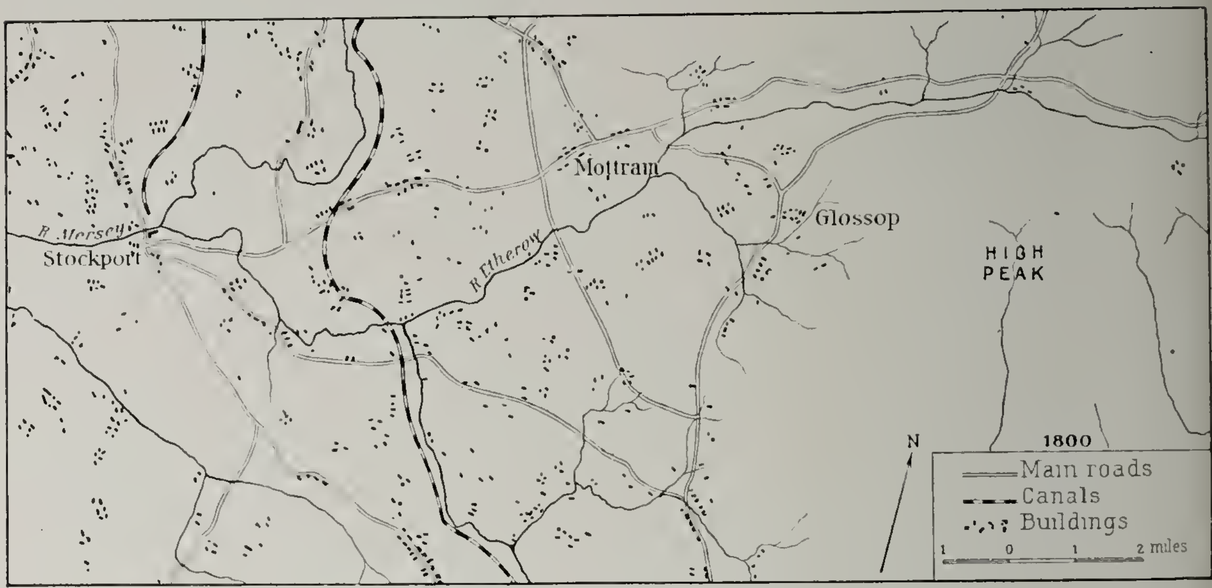

FIG. 16—Stockport and Longdendale about 1800 A.D.

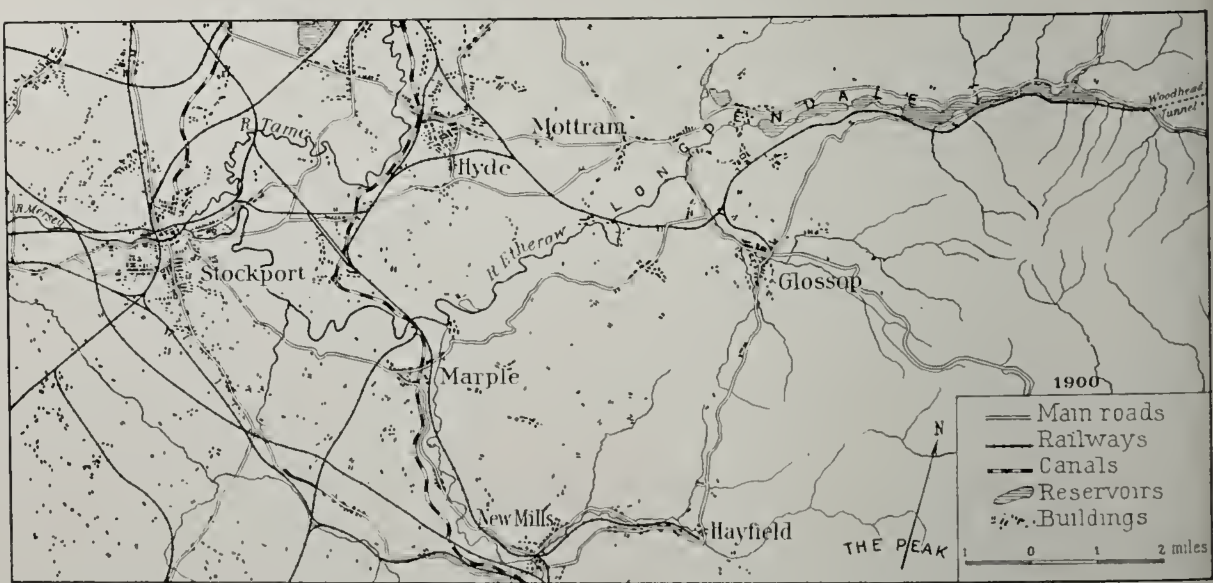

FIG. 17—Stockport and Longdendale about 1900 A.D.

Aikin's map is, on the whole, an excellent piece of cartography; the rivers are well drawn. The main rivers and canals have scarcely altered during the century; the upland still contain few houses. But note the buildings in modern times. Manchester, which is just off the northwest corner, stretches continuously to Stockport and Hyde, and Stockport extends almost in the same way to Marple and New Mills. The new railways form a notable addition to the map. The reservoirs were built to give Manchester an adequate supply of water; they date from about 1850. The

Mersey below Stockport (on the edge of the map) was crossed by ferry until 1850; only since 1877 have adequate bridges been available. The buildings lie along the edge of the coalfield; at Dukinfield, west of Hyde, a pit over 6,000 feet deep was considered in 1880 to be one of the deepest in the world.

The Effect of the Railways. Before 1851 the early railways had formed part of the East and West Coast routes from London to the north; in this respect the iron road had accepted the tradition of the turnpike,—it crossed the area of the Southern Pennines in order to form connections between more important areas both to the north and to the south. During the period of the railway mania in the forties much of the capital subscribed to the numerous schemes came from Manchester and Liverpool, which were desperately anxious to open communications to the south.

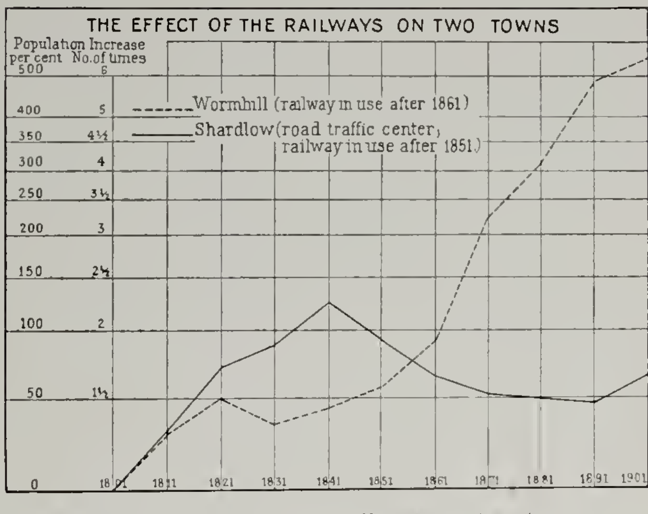

FIG. 18—The effect of the railways on two towns.

Consequently the railways may be regarded as a dynamic factor influencing the population from without. Some direct results of railway construction are to be seen in Figure 18. At Shardlow there had been a large posting station, but when the railways served the nearby town of Derby the people of Shardlow migrated. At Wormhill the convenience of the railway brought inhabitants after 1861. In most other cases the effect of the railways cannot be disentangled from the effect of coal and cotton, so that the influence of the iron road can only be traced in Figure 11 by the examination of the new railways as they were gradually constructed. The main features of the railway connection were determined before 1851, so that the rest of the century was spent in adding connecting links and in duplication of routes; at the same time the existing routes increased the number of tracks from single to double and often to quadruple sets of metals.

The Great Northern Railway connection through Newark and Retford, opened by 1861, brought the great East Coast route to its present track from London through these towns to York and Newcastle and displaced Derby. Cross-connections between Stoke, for example, and Northwich were made in three stages. The eastern colliery district is noteworthy for its numerous railways, which are thoroughly linked together by routes which have been steadily developed since 1851. This progress was uniformly maintained, since during the period 1851-1901 the number of people per mile of railway was steady at approximately 2,000. In 1851 about 14 per cent of the area was more than five miles from a railway line; but by 1901

no land was so far removed from the iron road. About two-fifths of the area was at least two miles from the railway in 1851, and this area was reduced to about one-fifth in 1901.

Conclusion

It will be well to summarize the main results of this investigation in a tabular form which necessarily takes notice only of prominent elements in the environment of these people who have lived on the edge of the industrial North and consequently have been affected by the triumphs of machinery and steam and yet have preserved elements of individuality; the cotton workers of Nottingham differ from those of Stockport, and the potters have a different character from the brewers of Burton. Only within the last few years of the nineteenth century is it true to say that the workers of a given industrial area have emerged to any degree from the isolation in which the early days of the industry were necessarily passed.

Summary of Environmental Influences and Their Effect on the Population

Occupation of the people	Static factors	Dynamic factors	Effects on the population
Coal mining.	Coal Measures.	(1) Establishment of factories, iron works, potteries near the coal to satisfy an external demand. (2) Roads, railways, canals, to connect the mining areas with the great trunk routes of England.	(1) Report steady increase at the maximum rate near the old collieries. (2) Sudden enormous increase when new pits were sunk. (3) Migration to coalfields from rest of area.
Cotton working.	(1) Rainfall and humidity. (2) Coal Measures.	(1) External supplies of raw cotton. (2) External demand for cotton goods.	(4) Immigration to coalfields from rest of England.
Pottery working.	(1) Coarse clay. (2) Coal Measures.	(1) External supplies of china clay. (2) Demand for pottery and china.	(5) Scarcity of labor on farms; therefore farms are small.
Salt mining.	Keuper marl.	Roads, canals, railways.	Steady normal increase.
Lead mining.	Mountain limestone.	World changes in sources of supplies of lead.	Decline.
Sheep rearing.	Mountain limestone, Bunter sandstone.	Absence of railway.	Sparse population with slight change.
Mixed farming for milk, oats and potatoes.	Rainfall (the wetter west).	(1) Demand for food supplies from factory towns.	(1) Comparatively dense rural population in west.
Mixed farming for milk, barley, wheat and turnips.	Rainfall (the drier east).	(2) World changes in farming cause (a) decline in wheat acreage; (b) increase in pasture land.	(2) Steady or declining population in general. (3) Migrations from the farms.

THE POSITION OF THE NEW ENGLAND PENEPLANE IN THE WHITE MOUNTAIN REGION*

By A. K. LOBECK

[With separate diagram, Pl. II, facing page 56.]

The extensive upland which covers much of New England is interrupted in its northern portions and especially in those most distant from the sea by several mountain groups. Chief among these are the White Mountains, which culminate in the splendid series of peaks and crests known as the Presidential Range, whose highest member, Mount Washington, lifts its summit a mile above the valleys at its base. From marginal peaks, as for instance Mount Kearsarge, near North Conway, a magnificent outlook to the east and south over the broad upland may be obtained, and so open is the view that it is even possible to see sailing vessels along the coast sixty miles away. Whether the White Mountains represent the northern part of the New England upland, strongly uplifted and dissected, or whether they are a group of monadnocks standing upon the remarkably well-developed peneplane recognized in the upland surface, is the thesis of this article.

The New England peneplane is one of the best-known topographic features of Massachusetts, Rhode Island, and Connecticut, and is characteristically developed in southern New Hampshire. The area as a whole has been made classic by the work of Professor Davis, and the reader is referred to his "Physical Geography of Southern New England" for a vivid picture of the character of the country.[1] Among the monadnocks in this part of New England he mentions Mount Monadnock in New Hampshire, Mount Wachusett and Blue Hill in Massachusetts. Professor Davis emphasizes the fact that "there are not many monadnocks in southern New England: the rolling upland is seldom dominated by any strong summits . . . . . but on passing northward into Vermont, New Hampshire, and Maine, monadnocks are common. The White Mountains seem to be only a cluster of unconsumed remnants . . . . . but, in spite of the nearness of these northern states, they have not been explored with the upland peneplain and the monadnocks in mind. No definite statement can at present be given as to the altitude of the upland in northern New England, or as to the degree of perfection that it attained. The region invites careful investigation." The same view was later expressed by Professor Davis as follows: "The White Mountains have been, in my mind, tentatively classed as a group of monadnocks; they do not, as

* My thanks are due to Professor D. W. Johnson of Columbia University, whose course in the Physiography of the Eastern United States first created an interest in this problem.

[1] National Geographic Monographs, American Book Co., New York, 1896, pp. 269-304; references on pp. 282-283.

far as I have seen them in brief excursions, stand upon any distinct basement comparable to that of the uplands of New England further south . . . . . Its [northern New England] ruggedness is generally so great that it is quite possible that the peneplain explanation does not apply to the greater part of the area. Little wonder that an observer whose attention is given to this mountainous district, under the impression that its mountain tops represent the remnants of a peneplain, should come to discredit such an explanation.'' [2]

The monadnock character of the White Mountains has also been pointed out by Doctor Bowman, who says[3] in addition that the ''plateau remnants that lie about their bases are from 1,000 to 2,000 feet elevation above the sea.'' He remarks[4] that ''The whole of Maine southeastward of the White Mountains axis is a gently inclined upland sloping with marked regularity toward the sea,'' and gives a section of local area which shows the remarkable degree of base-leveling that had been reached. While portraying one general character of the peneplane the section is, however, too far from the mountains and too close to the sea to serve as evidence of that relationship between the mountains and the upland which forms the theme of this paper.

On the other hand, Professor Goldthwait, in one of his interesting articles on the White Mountains published two years ago, made the rather striking suggestion that the flat-topped spurs near the summits of the range at an altitude of about 5,000 feet may represent remnants of an old graded upland and that quite possibly this upland is the northern extension of the New England peneplane.[5] Not only does he suggest ''that the subdued cones of Washington, Jefferson, Adams, and the other summits of the range are low monadnocks surmounting a peneplain whose only surviving fragments, in this district, are the upland lawns and Alpine pastures that lie along the crest of the range,'' but he points out the possibility that this peneplane is the New England upland so well known to the south.

A study of the region has led the writer to conclude that the New England upland is not to be recognized in the higher levels of the Presidential Range but that it abuts abruptly against the foot of the mountains. The flat-topped spurs described by Goldthwait are far above the upland level and cannot be correlated with it. The evidence leading to this conclusion was derived from a study of maps and from work in the field.

Map Evidence: Projected Profiles. The evidence available from the maps was secured by preparing a series of profiles in such a manner that the New England peneplane might be traced from the places where it is

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[2] W. M. Davis: The Peneplain, *Amer. Geologist*, Vol. 23, 1899, pp. 207-239; references on pp. 209-210.

[3] Isaiah Bowman: Forest Physiography, New York, 1911, p. 645.

[4] *Ibid.*, p. 646.

[5] J. W. Goldthwait: Remnants of an Old Graded Upland on the Presidential Range of the White Mountains, *Amer. Journ. of Sci.*, Vol. 37, 1914, pp. 451-463; reference on p. 453.

well known and easily recognizable to the White Mountain region, where its position is in doubt. The maps suitable for this purpose are (1) the contour maps in Hitchcock's atlas of New Hampshire[6] and (2) the topo-

FIG. 1—Diagrammatic sketch map of New Hampshire and western Maine showing monadnock masses and approximate distribution of the New England peneplane. Scale, 1:1,800,000. The position of the profiles of Figures 2 to 5 is indicated.

graphic sheets of the U. S. Geological Survey covering the White Mountains and the contiguous territory of western Maine.

The topography of belts of country three miles wide was so projected that any given point on the profile always represents the highest point in

[6] C. H. Hitchcock: Atlas Accompanying the Report on the Geology of New Hampshire, Julius Bien, New York, 1878.

the belt opposite such point in the profile. Such a profile is exactly that which would be obtained by isolating this belt of country and then looking at it from the side so that only the highest points form the line of profile. The result is an impression strikingly similar to that which one would get by looking at the country itself.

In choosing the width of belt to be projected for the purpose of revealing the existence of a badly dissected and monadnock-crowned upland, it is desirable to make the belt sufficiently narrow so that it will not encounter too many monadnocks and yet wide enough to span most of the valleys which happen to run parallel with it. If too narrow it approaches an ordinary profile and is unduly irregular because of the numerous valleys. If too wide it is also irregular, but this time because it covers so much country as to give a sky-line made up almost entirely of monadnock profiles.

The difference between this method of constructing profiles and that used by Professor Barrell[7] in his work on the supposed marine benches of Connecticut and Massachusetts is a minor one and depends mainly upon the information desired. In the method here used the tops of only those hills which form the sky line are projected. In that used by Professor Barrell the outlines of all hills in the foreground are also projected in order to reveal remnants of planes at lower levels.

A strip of country fifteen miles wide extending from the summits of the White Mountains to the sea was selected and subdivided into five parallel belts, each three miles wide. For each belt a projected profile was drawn on the basis of the contours shown in Hitchcock's atlas of New Hampshire. The position of this strip of country is shown in the sketch map, Figure 1, with the several belts marked A, B, C, D, E; and the series of projected profiles superimposed upon each other is shown in Figure 2. Each one of the profiles indicates that the New England upland in central New Hampshire ends abruptly at the base of the mountains at an altitude of 1,000 to 1,100 feet above sea level. The immediate coastal portion has been largely dissected or removed by the Exeter River and the tributaries of the Piscataqua and Merrimac Rivers. The position of Boott Spur, one of the flat-topped "remnants" at an altitude of 5,000 feet near the crest of the range, is also shown. It seems difficult to believe that this spur can in any way represent a part of the New England peneplane, which is so distinctly preserved at a much lower level. Several of the profiles pass through prominent monadnocks, as for example Ossipee Mountain, and some traverse pronounced lowlands, notably that now occupied by Lake Winnepesaukee.

A projected profile drawn from Mount Washington through southwestern Maine shows quite the same relation between the mountains and

[7] Joseph Barrell: Piedmont Terraces of the Northern Appalachians and Their Mode of Origin (abstract), *Bull. Geol. Soc. of Amer.*, Vol. 24, 1913, pp. 688-670; reference on p. 689.

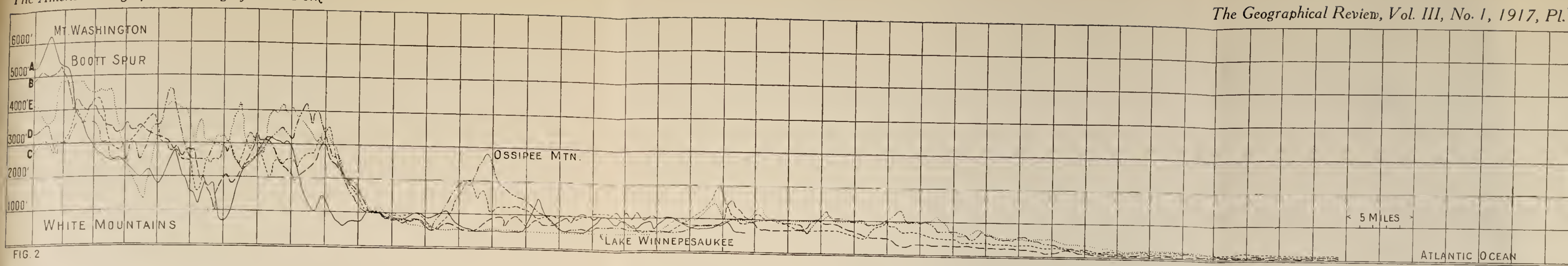

FIG. 2

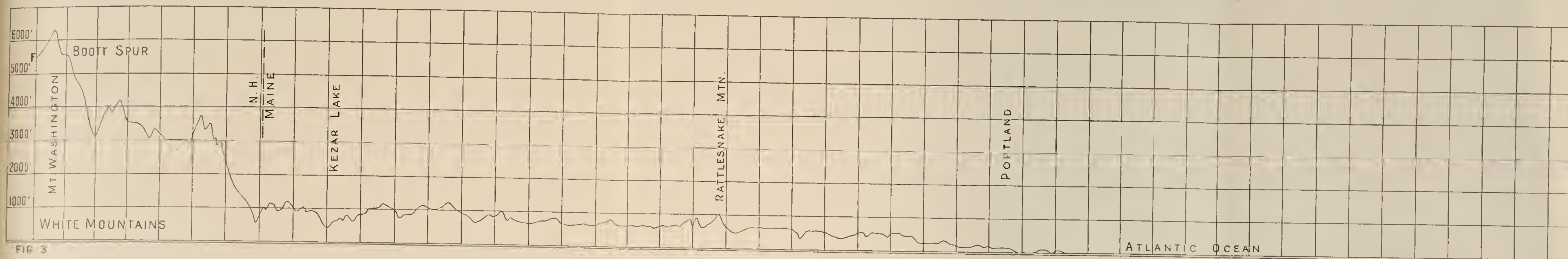

FIG. 3

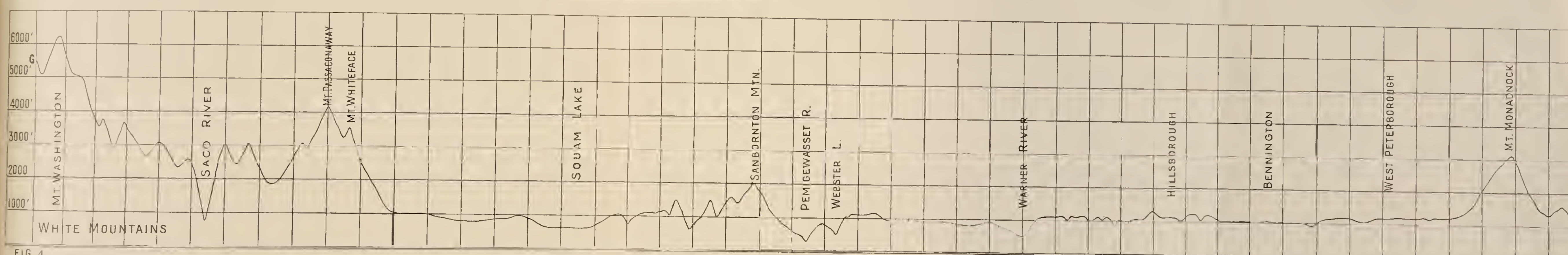

FIG. 4

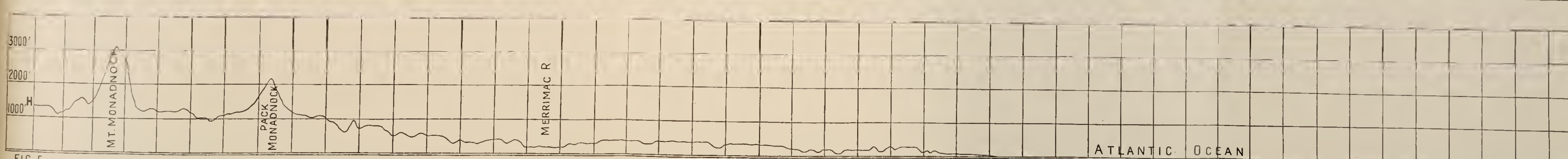

FIG. 5

Figs. 2-5. Profiles of the New England peneplane in the White Mountain region.

Fig. 2—A series of five projected profiles from the White Mountains through central New Hampshire to the coast.

Fig. 3—Projected profile from the White Mountains to the sea, passing through western Maine.

Fig. 4—Projected profile passing through Mount Monadnock and the White Mountains.

Fig. 5—Projected profile passing through Mount Monadnock to the coast.

FIG. 6.

FIG. 7.

FIG. 6—The New England peneplane at the base of the White Mountains north of Ossipee Mountain.

FIG. 7—Similar to Figure 6 in showing the helflike remnant of the New England peneplane flanking the White Mountains north of Lake Winnepesaukee.

the peneplane (Section F, Fig. 3). A similar projected profile covering a belt passing through Mount Monadnock and Mount Washington is shown in Section G, Figure 4. This section shows very distinctly the peneplane as characteristically developed around Mount Monadnock and proves its continuation northward until abruptly terminated at the White Mountains. Section H, Figure 5, a projected profile drawn east from Mount Monadnock to the sea, illustrates the character of the peneplane in southern New Hampshire.

The evidence from these sections is quite conclusive and seems clearly to place the New England peneplane at the base of the mountains at an elevation of approximately 1,000 feet.

Field Evidence. Field study shows that it is possible to trace the upland from its well-recognized position at the base of Mount Monadnock, where it stands at an elevation of about 1,100 feet, northeast along Contoocook River to near Concord, where its altitude is 800 feet. North of this point it rises again to about 1,000 feet near Lake Winnepesaukee. In central and eastern New Hampshire it is post-maturely dissected and the broad lowlands are occupied by lakes and alluvial plains which lie 400 to 500 feet below the peneplane level. In the Lake Winnepesaukee region it is, as a matter of fact, difficult to trace the upland for the reason that it is preserved only as fragments and the region is complicated by the presence of such residuals as Ossipee Mountain which rise directly from the lower lake-strewn plain. However, at the base of the White Mountains north of Lake Winnepesaukee, the upland is undoubtedly represented by a pronounced bench or shelf and adjacent remnants which stand at an elevation of nearly 1,100 feet. The photographs, Figures 6 and 7, show this remnant flanking the mountains which are visible in the distance. In the foreground is one of the alluvium-filled valleys cut several hundred feet below the peneplane level. These views were taken looking north near the little town of South Tamworth at the north end of Ossipee Mountain.

A critical point in the field for observation is Mount Kearsarge of the North, which stands almost at the southern edge of the mountains near North Conway. From this position toward the northwest the peaks and spurs of the Presidential Range are distinctly visible. To the south Ossipee Mountain stands out with the broken peneplane stretching away to the southeast. Just north of Ossipee Mountain is the lowland which separates it from the White Mountains. Along the base of the mountains and projecting into this lowland may be seen the shelflike remnant before mentioned. In the mountains there is no more suggestion of the peneplane. It is practically impossible from this viewpoint to conceive how the level upland terminating abruptly at the base of the mountains can also be represented by the spurs near the crest of the range at some 4,000 feet greater elevation. To the east there is a similar contrast between the re-

markably well-developed upland of western Maine and the steep slopes of the mountains.

Conclusion. An attempt is made in the sketch map, Figure 1, to indicate the areas in which remnants of the peneplane are now preserved. The map does not pretend to be precise in detail, but the comparative extent of dissected upland, monadnock residuals, and broad lowlands is suggested and may convey to the mind a useful picture.

We can describe the region of central and southern New Hampshire as a post-maturely dissected peneplane surmounted by numerous monad-

FIG. 8—Boott Spur, a remnant of the upland bench or terrace projecting from the side of Mount Washington.

nocks, especially away from the stream courses. The broad valley floors are covered with alluvium or, where blocked by glacial drift, form shallow though sometimes extensive lake basins, as that of Lake Winnepesaukee. The peneplane rises gradually from the coast and ends abruptly at the foot of the White Mountains, where its elevation is about 1,000 feet. In western Maine the peneplane is remarkably well preserved and appears to be less dissected than in New Hampshire. The conclusions derived from both field and map study are in strict accord, and one is constrained to believe that the spurs near the mountain crests have no relation to the upland so well developed to the east and to the south.

The fact that these spurs may have another meaning has not been overlooked by Professor Goldthwait. He gives as suggestions[8] "that the flat-

[8] J. W. Goldthwait, *op. cit.*, p. 462.

ness of the crown of the range is due chiefly to the more rapid reduction of the slopes above the tree line, where frost action and the movement of rock waste are more vigorous than in the forest,'' or ''that one might look for some structural control of the upland flats—some dominant system of joints, or some very extensive development of schistosity in plains near the horizontal.'' And he mentions the possibility ''that the flattening out of these graded slopes, in their descent, near the 4,000-foot contour is not as real as it appears to be; that the original well-graded slopes of the range have been so deeply and so widely scooped away by local glaciers and the resultant spurs have been so much worn, especially at low altitudes, by glaciation during the subsequent regional glaciation that the effect is a false appearance of an uplifted and extensively dissected cluster of low monadnocks.''

Observations by Professor D. W. Johnson on the north end of the range lead him to the opinion that the great discordance in the heights of the flat-topped spurs, amounting in cases to more than a thousand feet, and the fact that several of the supposed upland remnants have a high angle of slope, militate against any theory of their origin which would consider them parts of a former peneplane. My own brief study inclines me to believe that the spurs are not so pronounced a feature as to demand any special explanation.

ATLANTIS, THE "LOST" CONTINENT

A Review of Termier's Evidence

In order that its readers might have a well-balanced criticism of Termier's brilliant paper on the question of Atlantis, the "lost" continent of the Atlantic, the Society has requested two independent reviews. The first is by Dr. Rudolph Schuller, formerly of the Museo Goeldi of Pará, Brazil, a well-known specialist in historical geography, and the second is by Professor Charles Schuchert of Yale University, one of the foremost authorities in historical geology and paleontology.

Termier does not believe geology will solve the problem, though he uses arguments with geological implications. On the other hand, portions of the earliest maps recording the names and positions of the islands are based wholly on traditions whose origins it seems impossible to determine. To have both sides of the question discussed by competent critics is at least to put us in possession of Termier's strongest points.

(I) By RUDOLPH SCHULLER

For many centuries the question of Atlantis and other mythological islands said to exist beyond the Pillars of Hercules in the "shadowy," "gloomy" ocean have engaged the interest and enthusiasm of man. The same question has been lately taken up by a noted French scholar, Professor Pierre Termier, Director of the Geological Survey of France, in an article[1] which, from several points of view, is one of the foremost contributions to that complex theme.

Termier first transcribes the passage from the "Timæus," or "Concerning Nature," of Plato, who, as will be remembered, has preserved for us the tale of Atlantis. There are four speakers: Timæus, Socrates, Hermocrates, and Critias. The latter, in referring to Solon, the great law-giver of Athens six hundred years before the Christian era, tells of a journey that this ancestor of Plato made to Saïs, in the delta of Egypt. An old Egyptian priest revealed to him there the history of the beginning of Athens, "all but forgotten by the Athenians."

"That sea (the Atlantic)," we read in the most interesting part of the narrative, "was then navigable and had an island fronting that mouth which

[1] Pierre Termier: Atlantis, *Annual Rept. of the Smithsonian Institution for 1915*, pp. 219-234, Washington, 1916 (translated from *Bull. de l'Inst. Océanogr. No. 256*, Monaco, 1913).

For other recent discussions of the problem see—

Louis Germain: Le problème de l'Atlantide et la Zoologie, *Annales de Géogr.*, Vol. 22, 1913, pp. 209-226.

L. F. Navarro: Estado actual del problema de la Atlantis, *Bol. Real. Soc. Geogr.*, Vol. 58, 1916, pp. 178-212. Madrid.

you (Solon) in your tongue call the Columns of Hercules . . . . And there was a passage hence to the rest of the islands, as well as from these islands to the whole opposite continent that surrounds that sea . . . . . The island of Atlantis itself was plunged beneath the sea and entirely disappeared; whence even now that sea is neither navigable nor to be traced out, being blocked up by the great depth of mud which the subsiding island produced.''

As to the authenticity of Solon's trip to Egypt, we also possess the testimony of the historian Plutarch, who uses the words ''On the Canopian shore, by the Nile's deep mouth'' when dealing with the ten years' absence of the sage from Athens. The same authority, in referring to Plato's description of Atlantis, says: ''Plato, ambitious to cultivate and adorn the subject of the Island of Atlantis as a delightful spot in some fair field unoccupied, to which also he had some claim by reason of his being related to Solon, laid out magnificent courts and enclosures and erected a grand entrance to it, such as no other story, fable, or poem ever had. But, as he began it late, he ended his life before the work was completed, so that the more the reader is delighted with the part that is written, the more regret he has to find it unfinished.''

There can be no question that Plato's narrative of Atlantis has not at all the coloring of a mere fable. ''It is of an exactness almost scientific,'' Termier correctly observes.

From modern geological, zoölogical, and botanical researches, it seems highly probable that, during the geological period called Eocene and until the Pliocene and Miocene, a land-bridge across the present Atlantic Ocean connected Europe with this continent. A cataclysm followed. Submersions and convulsions entirely changed the aspect of that section of the earth. It is not known whether they were of tectonic or of volcanic origin. Termier seems to assume the latter. The West Indies, the Bermudas, the Canaries, the Azores, and other islands may be the remains of the vast island or continent submerged in the Atlantic Ocean. Was such a catastrophe possible? The cataclysm is undoubted, asserts the French scholar. ''One thing alone,'' says he, ''remains to be proved—that the cataclysm which caused this island to disappear was subsequent to the appearance of man in western Europe.''

Termier does not believe that the question respecting Atlantis, the ''fabled island'' of most authors, is insolvable, though neither geology nor zoölogy, he observes, will solve it. ''These two sciences appear to have told all that they can tell; and it is from anthropology, from ethnology, and, lastly, from oceanography'' that he is ''now awaiting the final answer.'' Of course, it is a *petitio principii.*

As to anthropology, it seems to me very opportune to refer here in brief to the general conclusions reached by Dr. Hrdlička of the United States National Museum with regard to the origin of man in America in his

paper "The Genesis of the American Indian" presented to the last International Congress of Americanists, Washington, 1916.[2]

The author first considers the question of the unity or plurality of the American race. In answering this question he decides in favor of the original unity of the Indian race in America. He bases his conclusion upon the similarities of language, culture, mentality, and physique. Then he takes up the question of the antiquity of the race on this continent. Hrdlička does not think that the Indian was autochthonous on this continent. This belief is based upon the absence of the inferior primates of the anthropoid type in America, upon the assumption of the unity of the species *homo sapiens,* and upon the circumstance that the primitive types of humanity living in Europe during the Quaternary or Glacial Period could not have come from America. According to this authority, no human remains of geological antiquity have been demonstrated to exist on the American continent. The third question he considers is the source of the racial elements that occupy America and the epoch of the occupation.

With respect to the first point Hrdlička passes in review the means of transportation of prehistoric man; the geographical situation of America with regard to the other continents; the anthropological characteristics of the American Indian, which he compares with the primitive characteristics of the great ethnic groups of other parts of the world. And from these considerations he concludes that the American aborigines come only from Asia.

Here we have another *petitio principii.*

On the other hand, famous anthropologists have persistently rejected the alleged Asiatic origin of American man.

Of course, relations between America and Asia, through Bering Strait, have formerly existed and still exist.[3] But we should not forget that Siberia was peopled only in a relatively recent period, in Neolithic time, and that during this period the opposite land of Alaska was covered in part by enormous glaciers, a circumstance making relations between the man of the Old World and of the New World through these regions rather improbable.

Now, accepting, as Dr. Hrdlička does, the theory of the unity of mankind, then it would appear as if we are obliged to go back to a distant geological past to prove the connection, and to assume the peopling of America from Europe. And this theory is, as far as I know, accepted by the greatest specialists in paleo-anthropology, as, for instance, Dr. Robert Lehmann-Nitsche of the La Plata Museum, and also by other noted scientists, such as Andree and Luschan.

The above quoted land-bridge, if it existed during the Eocene and until

[2] Not yet published.

[3] On one phase of these relations, the migration of mythological elements, see Paul Ehrenreich: Mythen und Legenden der südamerikanischen Urvölker und ihre Beziehungen zu denen Nordamerikas und der alten Welt (Supplement to *Zeitschr. für Ethnol.*, Vol. 37, 1905), pp. 67-68 and 77, based on the work of Boas and the Jesup North Pacific Expedition, 1897-1903.

the Pliocene and Miocene, would furnish the original connection of the early man of the Old and the New World.

Be that as it may, the antiquity of man in America is so great that—at least in the present state of our science—we can consider him autochthonous. The same may be said of American native culture and civilization. They may have received certain elements from outside; however, these infiltrations of alien cultural elements could never have influenced to any great extent the spontaneous development of American native culture.

"Did man," asks the French author, "then live who could withstand the reaction and transmit the memory of that cataclysm?" This is thus far an open question. One link is missing. Atlantis was plunged into the "gloomy sea." And will it ever be possible to disclose what the waves of the ocean conceal? I will leave it to others to answer this question.

Many scholars have thought Atlantis to be America, because Plato states that an easy passage existed from this island to other islands which lay near a continent exceeding in size all Europe and Asia. Of course, most of these accounts are speculations without scientific foundations. To prove that in Plato's work there are to be found allusions to the western hemisphere, the alleged evidence ought to be, if not incontestable, at least serious and plausible.

In the first instance, the philosopher speaks of an island called Atlantis. And the tale of the submerged island has been for many centuries the favorite theme of the superstitious mariners of the maritime centers of western Europe. As an island it is also preserved on the first cartographical productions. After the discovery of America, its name, in the form of "the Antilles," was given to the islands at the present termed "West Indies."

The study of the problem of the Island of Atlantis is unquestionably of high scientific importance. The fact that the narrative of the island's submersion has been regarded by most scholars as a "fabled tale" proves little or nothing. United science may be enabled to tell us who were those men who lived, loved, and labored in that western island ages before the tradition gave rise to the legends regarding the dangers and horrors pervading the "gloomy ocean."

(II) By CHARLES SCHUCHERT

It is well known that Professor Termier is not only a good geologist but also a great lover of the beautiful and much given to the poetic form of speaking and writing. At the recent meetings of the International Geological Congress in Canada many of us came under his spell, and we are thankful to the Smithsonian Institution for presenting so good a translation of the stimulating lecture on "Atlantis" that he delivered at the Oceano

graphic Institute of France in 1912.[1] Most of us will agree with the facts presented, but as to his conclusions there will be differences of opinion of a fundamental kind.

We learn from Plato that an Egyptian priest told Solon (born 638 B.C.) that Atlantis, "larger than Asia and Africa," was destroyed with great earthquakes and inundations; "in a single day and one fatal night, all who had been warriors against you [Athenians] were swallowed up. The Island of Atlantis disappeared beneath the sea," seemingly at some time between 5,000 and 9,000 years before the Christian era. Atlantis had "white, black, and red" building stones and "mines yielding all the metals useful to man." Plato's description, according to Termier, "tallies well with what we would imagine today of a great land submerged in the region of the Azores," a continent sunk into the "sea of darkness" of the Egyptians, a darkness that was not dispelled until Columbus discovered America.

Termier tells us that all of the eastern Atlantic is a great volcanic zone, stretching from Iceland south for 1,900 miles, that off Europe and Africa volcanoes are abundant, and, in fact, that many of the islands in this zone "are either integrally or in greater part formed of lava," most of them rising steeply out of great depths. The Azores are true volcanic and oceanic islands, and it is almost certain that they never had land connections with the continents on either side of the Atlantic Ocean. If there is any truth in Plato's thrilling account, we must look for Atlantis off the western coast of Africa, and here we find that five of the Cape Verde Islands and three of the Canaries have rocks that are unmistakably like those common to the continents. Taking into consideration also the living plants and animals of these islands, many of which are of European-Mediterranean affinities of late Tertiary time, we see that the evidence appears to indicate clearly that the Cape Verde and Canary Islands are fragments of a greater Africa.[2] It is therefore not to the north of the Pillars of Hercules that we should look for Atlantis, but to the southwest of the rock of Gibraltar. What evidence there may be to show that this fracturing and breaking down of western Africa took place as suddenly as related by Plato or that it occurred about 10,000 years ago is as yet unknown to geologists.

Termier relates that a cable-laying ship grappling for the broken Brest-Cape Cod cable in 1898 brought up from depths averaging 3,000 meters rock splinters of a vitreous lava, a basalt known to petrographers as tachylyte. He regards this occurrence as of the greatest significance in showing that a large area of the Atlantic has gone deep beneath the surface of the ocean, concluding that the rock "could solidify into this condition only under atmospheric pressure. Under several atmospheres, and more especially under 3,000 meters of water, it might have crystallized." This

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[1] See footnote 1 to preceding section.

[2] See C. Gagel: Die mittelatlantischen Vulkaninseln, *Handbuch der regionalen Geologie*, Vol. 7, Part 10. Heidelberg, 1910.

lava field having, as he holds, formed above the level of the sea, has since sunk 9,750 feet. However, as to vitreous lava also forming beneath the sea he says nothing, but petrographers admit that they know little of this possibility. At least some of them believe it can form also at the great depth cited, where the temperature of the water is near the freezing point of the Fahrenheit scale. It is not pressure so much as it is a quick loss of temperature that brings about the vitreous structure in lava. In other words, vitreous lava apparently can be formed as well in the ocean depths as on the lands. What the cable layers got was probably the superficial glassy crust of probable subterranean lava flows, and the presence of tachylyte on the ocean bottom can hardly be regarded as proof positive that a large area of the North Atlantic, recently land, is now about 10,000 feet beneath the sea.

The greater question, Was Africa ever united to South America? is being answered by biologists and geologists "Yes" and "No." The writer believes in this connection previous to the Tertiary, and thinks that the down-breaking of western Gondwana began in the late Lower Cretaceous, with complete severance long before the close of Eocene time, for marine strata of this age are general along the western border of Africa. (Gondwana during Paleozoic and Mesozoic time extended unbroken from India across the Indian Ocean to Africa south of the Sahara Desert, and across the Atlantic, embracing Brazil and much of South America.) On the other hand, if this land-bridge had continued unbroken into Tertiary time, even only as late as the later Eocene, then certainly the wonderful fossil mammalian faunas of Argentina should reveal many and unmistakable African links. The African affinities in the ancient South American mammalian faunas are, however, so slight as to give but a limited support to the theory that Gondwana was still in existence in early Tertiary time, and none at all to the theory that the South Atlantic bridge was present in the Miocene.

Even though we do not agree with Professor Termier's thesis that there is truth in Plato's Atlantis, we thank him for the glowing account he has given us, with its incidental revelations of French warmth of character and nobility of mind, and for the stimulus that the article will give to paleogeographic research.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Meetings of December. An inter-monthly meeting of the American Geographical Society was held on Tuesday evening, December 12, 1916, at the Engineering Societies' Building, 29 West Thirty-ninth Street. President Greenough presided. The lecture for the evening was entitled "The Argentine Pampas," by Charles Wellington Furlong, F.R.G.S. Mr. Furlong related his experiences on a journey across southern Patagonia from the Atlantic to the Andes. He also described the life of the Tehuelches, the Indians of that region, and the Onas, who inhabit Tierra del Fuego. These and other Fuegian peoples are dealt with in the article by Mr. Furlong in the present number.

The regular monthly meeting was held on December 26. President Greenough presided. He submitted for confirmation the names of 532 candidates for Fellowship, each of whom had been approved by the Council, and they were confirmed as Fellows of the Society. Thereupon Mr. Arthur Stanley Riggs delivered a lecture entitled "Colonies, Old and New."

NORTH AMERICA

A Proposed 30-Mile Tunnel under the Cascade Mountains. The Cascade mountain wall which divides eastern and western Washington has proved a barrier to the development of Puget Sound as a Pacific terminal for continental traffic. At various times in the past ten years, rail traffic across the Cascades has been stopped completely in winter by the heavy snowfall for periods of one to three weeks, and grave accidents and loss of life have occurred through avalanches. A plan to conquer this natural obstacle more adequately than at present is set forth by Brigadier-General H. M. Chittenden in *Engineering News* for November 16, 1916 (pp. 928-935). It involves the building of a tunnel about thirty miles long between the valleys of the Wenatchee and Skykomish. This is practically the route at present followed by the Great Northern Railway, which pierces the crest between the headwaters of the two rivers in the Cascade Tunnel, 13,500 feet long and 3,375 feet above sea level. The tunnels by which the two other railroad crossings of the range are effected lie farther south: the Snoqualmie Pass Tunnel, used by the Chicago, Milwaukee, and St. Paul Railway, 11,890 feet long and 2,560 feet in elevation, and the Stampede Tunnel, used by the Northern Pacific Railway, 9,834 feet long and 2,837 feet above sea level (for these routes see map in *Bull. Amer. Geogr. Soc.*, Vol. 43, 1911, p. 520).

The Wenatchee-Skykomish route is considered the most advantageous because these two opposite-flowing rivers lie almost in a straight line and also because this route crosses the range at a point where it is restricted by the westernmost projection of the Columbia Plateau. Instead of having to climb to the present tunnel elevations of 2,500-3,400 feet, the trains in the proposed line would never rise more than 1,200 feet above sea level and the maximum gradient would be reduced from 2.2 to 0.6 per cent.

In its technical aspect, the construction presents no difficulties which modern engineering cannot surmount. The cost is estimated at $50,000,000, and the time required for the completion, from five and a half years to thirteen according to the method adopted.

A comparison with the length of tunnels in the Alps is of interest. The great European mountain mass is pierced by five tunnels: Mont Cenis, length, 8 miles; Saint Gotthard, 9.2 miles; Arlberg, 6.5 miles; Simplon, 12.3 miles; Loetschberg, 9 miles.

The Exploitation of Potash in Nebraska. Jesse Lake, near Alliance on the western margin of the sand hills region of Nebraska, is acquiring fame as the site of a new American industry, the production of potash salts on a commercial scale. The industry's plant is said to be the first of its kind in North America (Victor Ziegler: The Potash Deposits of the Sand Hills Region of Northwestern Nebraska, *Colorado School of Mines Quarterly*, October, 1915; compare the note on the "Potash Resources of the United States" in the March, 1916, *Review*, p. 217). Salts extracted from the brine-saturated sand underlying the lake are used in the manufacture of fertilizers, and concentrated brine is also shipped to Michigan for use in the treatment of magnesia brines. Jesse Lake is one of the most strongly alkaline of the many lakes that are found on the pitted, wind-scoured surface of the sand hills region. The majority of the lakes are fresh or only slightly alkaline, but the waters of a small proportion are sufficiently mineralized to merit commercial consideration. Most of these are small, the average area being perhaps 100 acres. Jesse Lake is one of the larger members:

it has an area of 240 acres, and its saline content is estimated at something over 100,000 tons.

The origin of the Nebraskan deposits is attributed to human interference with the original plant cover. Before white occupation the Indian population had burned over the prairie and extensive woodland and exposed the surface to the erosive influences of a semi-arid climate. Mineral ashes from the destroyed vegetation washed into the waters that collected in the wind-hollowed depressions. Where an outlet was lacking the waters, subject to intense evaporation, became rapidly enriched in saline content. In the case of the alkali lakes properly so-called the total salts averages 4 to 6 per cent, a commercially workable amount if the extent of the deposit is sufficiently great.

Bureau of Soils Publications as Geographic Material. In the *Field Operations* and soil maps issued every year by the Bureau of Soils of the U. S. Department of Agriculture students of geography may find a rich and rapidly growing stock of new source material.

When the mapping of each unit area, usually a single county, is completed a report on it is issued in booklet form. The distinctive feature of the reports is the accompanying map of the soil types in a color overprint upon a very accurate base map in black and white on the scale of one mile to the inch. Annual volumes comprising the fifty or more booklets put out during the year are also obtainable.

To illustrate the method of treatment in each areal discussion and to exhibit the wealth of geographic material in these reports, that on Will County, Illinois (as found in the *Field Operations of the Bureau of Soils for the Year 1912*, pp. 1521-1553) is here discussed in some detail.

In the field of place geography, the report describes the drainage and its relation to the great waterways, the Mississippi and St. Lawrence systems; the location of the area with reference to state boundaries and physiographic region lines, and to the main features of the continental glacier; its position with reference to trade routes, waterways, railroads, and to the large cities.

In the field of economic geography, the uses of the streams, for power, navigation, water supply, and scenic points are discussed. Railroads, canals, and wagon roads are described. The condition of the roads and facilities for improving them, supplies of gravel, stone, and clay for brick roads are treated.

From the climatic side not only the bare statistics of averages, means, and extremes are given, but dates of killing frosts, length of growing season, distribution of precipitation through the year and in relation to the growing season, ''dry spells,'' probability of hail and other destructive storms, and the temperature extremes in their relation to certain crops. Then comes the rainfall in relation to run-off, soil absorption and evaporation, and floods.

From the historic viewpoint are discussed the original condition as to forests, grass, game, fish, and travel, together with their relation to early settlement and development and the present culture.

Causal relations are kept well to the front. Soil types are placed and correlated with glacial and rock features and post-glacial processes. Their origin and character are carefully worked out, and their present uses and possibilities are connected with their history. The need of underdraining, facilities therefor, and materials for making drain tile are considered. Topography is not only treated descriptively, but is explained; abandoned lake beds, beaches, and moraines are located and their relation to the soils and crops is defined. The effects of both soils and topography upon the people, their distribution, occupations, and wealth are interpreted. The relation of this area to other areas and to Chicago and other markets is shown; its development is correlated with theirs.

Even the element of prognostic geography is included, in suggesting new uses for the soils and slopes, and new adjustments that can be made both to the advantage of the county and its people and also to the city markets.

Each areal report is similarly informing and stimulating. George D. Hubbard.

The Forests of Porto Rico. Originally as well-wooded as the neighboring Santo Domingo, of whose area 85 per cent is still under virgin forest, Porto Rico is fast running through its reduced woodland resources. Only two per cent of the surface is ''high'' forest (tropical rain-forest), and, with the so-called ''timber and brush'' lands, the total of woodland is not more than 20 per cent. Yet the country is consuming annually three times as much as it produces. At such a rate depletion will be complete in less than a score of years. This condition is attributable in the main to the density of population: Porto Rico has 235.5 people to the square mile where Santo Domingo has only 33.

In the removal of the forests organized lumbering has played no part. Clearing for

agricultural purposes and charcoal burning are almost solely responsible for the denudation. The wasteful system of primitive tropical agriculture has been particularly harmful to the forests. The same spot is seldom cultivated for more than three years in succession; then another patch, preferably of virgin forest of the better type, is burned out. On the abandoned clearings grass, chaparral, or a savanna formation often compete successfully with secondary forest. Thus has originated much of the so-called pasture of little use even for stock. The total area under pasture occupies 47 per cent of the island. On the contrary the acreage devoted to commercial crops at the expense of the forest is economically justified. Sugar occupies the level, agricultural lowlands, and coffee, which grows best on steep slopes above 2,000 feet, conserves the soil cover to a great extent.

Of the original tropical rain-forest only three considerable tracts remain: that of the Sierra de Luquillo on the east and two smaller areas on the center and west center of the island cordillera. The virgin forest of Luquillo has been protected from man by the steepness of its wind- and rain-swept slopes. Part of it has been created a government reserve. Most of the remaining government land is in the grass and brush region. Afforestation could be put into practice here, but, as the extent is not great, co-operation with the land owners must form the basis of a sound forest policy. Such a proceeding, however, will be difficult, for most of the mountain holdings are small (Louis S. Murphy: Forests of Porto Rico, Past, Present, and Future, *U. S. Dept. of Agric. Bull. No. 354,* 1916).

Central American Railroads. The growth of railroad enterprise in Central America is the subject of a pertinent article in the International Edition of *Dun's Review* for October, 1916. The earliest line was that built across the Isthmus of Panama under the stimulus of the Californian gold discoveries. Begun in 1850, this short ocean-to-ocean line was only opened to traffic in 1855, after a tremendous expenditure of human life. The present line does not follow the first surveyed locations, as it has been rebuilt in parts on new rights-of-way. A new line which will eventually connect David in the southwestern part of the republic with Empire in the Canal Zone is now under construction.

North of Panama, in Costa Rica, transcontinental travel between Punta Arenas and Puerto Limon is made possible through the connection at San José of the Pacific and the Northern Railways. In Nicaragua, Leon and the important cites of Managua and Granada are connected with the Pacific ocean at Corinto. For some years proposals have been under discussion to complete transportation facilities to the Atlantic. The April, 1916, number of the *Bulletin of the Pan American Union* reports that the Pacific Railroad Company has submitted to the Nicaraguan congress a project for construction of a line between Managua and Bluefields. Salvador as yet has no means of direct communication with the Atlantic: completion of the construction undertaken by the International Railways of Central America will, however, make connection with their transcontinental road in Guatemala. This last-named line, the northernmost of the three transcontinental connections in Central America, unites Puerto Barrios on the Atlantic with the principal Pacific harbors of the republic. Here, as well as in the other republics of Central America, the main centers of activity are situated on the west coast, and railroad building has consequently progressed more rapidly on this side.

In addition to these lines many miles of plantation railways are operated by the large companies which have played an important part in the development of Central America. Over 250 miles of these lines, belonging to the United Fruit Company, are in operation in Panama alone, while on the Atlantic side of Costa Rica a network comprising 170 miles of track is owned by and operated by the same company. In Honduras this prosperous concern runs over 161 miles of plantation railways.

SOUTH AMERICA

Human Life in the Flood Region of Lowland Bolivia. A brief but interesting description of the lowland region of eastern Bolivia is given by the ethnologist Erland Nordenskiöld in a recent paper ("Die Anpassung der Indianer an die Verhältnisse in den Überschwemmungsgebieten in Südamerika," *Ymer,* 1916, No. 2). A valuable map shows the outlines of the area so extensively flooded each year during times of high water. It lies between the Andes and the Guaporé and extends northwestward to the Madidi and southeastward to the belt of higher country northeast of Santa Cruz.

Here is a region of great extremes. At times of low water the inhabitants may be required to dig to ground-water and in times of high water the same people may be able to travel only by canoe. The extensive inundations push the edges of cultivation to the higher ground and flood hundreds of villages. Even such a large town as Trinidad is

not immune, for it is said that it has but one street which has not been submerged. The rainy season begins in October, November, or December and continues until April or May, but it is not until late December or early January that the pampas are flooded sufficiently to interfere with trade.

The point of chief interest lies in the description of the numerous canals which connect the rivers and their main tributaries. By means of these canals one may cut across country in many places, thus saving long detours. The author inclines to the view that these canals are not natural features but are artificial products associated with Arawak culture. The inquiry is extended to other regions of the Amazon basin; for example, north to the Casiquiare, thence to the Orinoco and the Rio Negro. He gives a small-scale map of the region. Here again is a field of Arawak culture. The point raised is extremely interesting, and more refined hydrographic studies are now required to advance any argument in support of a natural origin for the connecting canals.

The Argentine Census of 1914. The United States consul at Rosario reports briefly on the first published returns of the Argentine census taken in 1914 (*Commerce Repts.*, No. 250, Washington, 1916). Argentina is now credited with a total population of 7,885,237, practically double that of the preceding census of 1895. The greatest growth is shown in the vine-growing Andean province of Mendoza, where the increase is 139 per cent. Large increases are also recorded in the provinces of the wheat belt. For the country as a whole the population density is 7 per square mile. Tucumán, with 40 inhabitants to the square mile, remains the most densely peopled province. Of comparatively small extent, it embraces a large proportion of plains-country well adapted to the sugar cultivation upon which its prosperity depends. Catamarca, lying immediately to the west and occupied by plateau and cordillera, has, on the contrary, less than 3 to the square mile. Misiones, with 5 to the square mile, has by far the greatest density of the National Territories. Much interest attaches to the statistics in regard to nationality, for thirty per cent of the population is foreign. This is a topic that will be discussed in a later issue of the *Review*.

Physical Changes during Historic Time in the Rio de la Plata Estuary. Within the last four hundred years important physiographic and biologic changes have taken place in the basin of the Rio de la Plata (Aníbal Cardoso: El Río de la Plata desde su génesis hasta la conquista, *Anal. del Museo Nacional de Hist. Nat. de Buenos Aires,* Vol. 27, 1915). The early explorers left us little in the way of detailed geographical description. Broadly they picture the shores of the great estuary from Montevideo on the east to Buenos Aires on the west covered with woods and thickets where abounded the jaguar and puma. Beyond the riverine bluffs of the west the Querandíes engaged in the pursuit of deer, guanaco, and the wild horse. In similar fashion the Charruas occupied the eastern country, whilst the friendly and pacific Guaraníes cultivated the islands of the delta. References to hydrography are few, but we glean enough to appreciate the practical importance of the changes that have transpired since the discovery of the estuary.

The exact date of the discovery remains doubtful. The first authenticated entry is that made by Juan de Solis in 1516, but it is a commonly held opinion that he effected an early voyage "in secret." Solis confined his exploration to the Banda Oriental; subsequent navigators crossed over to the western shore. Magellan, who appears to have reached the neighborhood of the modern La Plata, sailed the estuary at a speed precluding the idea that he had to feel his way by soundings. Cabot passed from the Uruguayan coast to the river Las Palmas without difficulty. The reports on his voyage are amongst our most valuable sources. They include the map showing the site of Sancti Spiritu, the first and only town in La Plata before 1536; the diary of one of his soldiers, Luis Ramirez; and the memoir of his rival, Garcia. A little later Pedro de Mendoza, founder of the first settlement of Buenos Aires, likewise crossed without trouble from Colonia to the playa on which he laid out his ill-fated colony. As late as the end of the sixteenth century this unimpeded navigation along the western shore was the experience of the largest vessels of the time. Useful data on the condition of the estuary are found in the log of a Dutch boat sailing to the La Plata in 1599. (This log in original form and as a Spanish translation is to be found in the *Anales de la Biblioteca: Publicación de Documentos relativos al Río de la Plata,* Vol. 4, Buenos Aires, 1905.)

These early observations, in harmony with physiographic evidence, suggest that with comparatively little labor and expenditure the ancient channels might be restored and vast improvement effected in navigation of the Argentine side of the upper estuary, at present only available for boats of small draft. The most direct route to the Paraná follows the channel of the Rio de las Palmas, but the bar near the mouth closes it to

vessels drawing nine feet or more. Projects to canalize this waterway to Buenos Aires have long been under consideration. A year or two ago the Argentine Senate granted a concession for the construction of the Mitre Canal, as it is called. Alternative schemes and a plan of existing and proposed routes may be found in a paper by Agustín Mercau (Canalización Artificial del Río de la Plata, *Anales de la Soc. Científica Argentina*, Vol. 62, Buenos Aires, 1906).

EUROPE

Revival of the English Channel Tunnel Project. The European war has created a revival of interest in the project of a tunnel under the English Channel. The *Engineering Record* for November 25, 1916, reproduces an article (pp. 645-646) contributed by A. Dumas in *Le Génie Civil* for October 21, 1916, in which the estimated cost of the tunnel is set at $77,000,000. Yet it is believed that the venture would prove immediately profitable. According to conservative reckoning, fifteen freight and passenger trains pulling an average load of 500 tons could be operated daily in each direction. It is estimated, however, that during the war 144 troop trains a day could be operated in one direction. An important saving would be accomplished by eliminating the present transfers between rail and water. The scheme has the great advantage of reducing the running time between London and Paris by 5½ hours, thus bringing the two capitals as close together as New York and Boston.

The plan calls for the building of twin, single-track tunnels. Only 37 miles of track are required to provide connections with the Paris-Calais and London-Dover railways. Of this distance 32 miles would be actually under water. Geological conditions appear to be favorable to tunnel construction. Its course will be laid in a highly impervious bed of argillaceous chalk (Cenomanian), which shows closely similar outcrops on either side of the channel. These outcrops determine the points of departure from the respective shores, Sangatte, north of Cape Blanc Nez, and Shakespeare Cliff south of Dover.

As is well known the scheme is by no means new. It was suggested in Napoleon's time and seriously considered before the mid-century, since when French engineers have always been interested in the venture, although considerable opposition has been met with on the British side. In 1875 a French company obtained a ninety-nine year franchise and constructed a tunnel over a mile in length from the French shore before matters reached a deadlock in 1882. This work, as well as a corresponding section at the English end built about the same time by the Channel Tunnel Company, is now available.

The *Engineering Supplement of the London Times* (August 25, 1916) discusses the tunnel scheme in relation to other solutions of cross-channel communication without transshipment—that is, apart from aircraft, by bridge or train ferry.

Iron Mining in Normandy. By the revival and new development of its iron mining, Lower Normandy, commonly regarded as a purely pastoral and agricultural region, bids fair to experience an industrial revolution not unlike that which took place in French Lorraine a quarter of a century ago. Present operations are centering around Caen, the chief port of shipment for the mine products and of entry for the imported fuel. The recrudescence of what is here a very ancient industry began with the introduction of German capital in 1909. According to the British Consul-General at Havre (*Board of Trade Journ.*, Oct. 19, 1916) the output in 1900 was only 142,000 metric tons: now, with the mines under government control, it is over 1,000,000 metric tons and is being steadily augmented. The progress of the industry is described in the article ''El Fierro en Normandía'' in the Chilean mining publication *Boletín de la Sociedad Nacional de Minería* (Vol. 27, Ser. 3a, No. 219, Santiago, 1915).

The Revolution in Russian Agriculture. Since the liberation of the serfs in 1861 the dominant form of land cultivation in central and eastern, especially northeastern, Russia has been the communal system. The system is a natural one in a vast, undeveloped region sparsely peopled and without capital, but it limits agriculture to a low standard. Visualize the bars to progress in the way of the peasant whose allotted land is subdivided into a hundred long, narrow strips, some perhaps not more than four or five feet wide, scattered over the communal holding of some hundreds of acres in extent! Advancement on a general scale is as clearly beyond the powers of the individual as in a different way it is with the Kentucky mountaineer.

Appreciating the necessity for outside assistance the Russian Government has for the last ten years taken a hand in the solution of the problem. Much effective work has already been carried out by the land commissions and the peasant's banks. The former have been authorized to break up the communal holdings and redistribute the

land in single blocks. With the banks they also arrange for the provision of farm buildings, implements, and other requisites for the peasant starting on his new career. Several instances of the success of the movement are related in the May, 1916, number of *Russia* (R. Martens & Co., New York). They have been drawn from the official publication "Les Travaux des Commissions Agraires (1907-1911)," St. Petersburg, 1912.

The Economic Divisions of Albania. We are indebted to Italian interest in Albania for a gradually increasing knowledge of this ill-known principality. A summary of the results attained by the Italian Scientific Mission sent to Albania in 1913 by the Società pel Progresso delle Scienze is given in the May, 1916, issue of the *Rivista Mensile del Touring Club Italiano* (pp. 290-292). From the standpoint of human occupation the land of Albania is divisible into four distinct zones extending from the summits of the inland uplifts to the shores of the Adriatic.

The highest of these zones comprises the limestone region of central Albania. It is extremely rugged and sparsely populated. Dotting the slopes between gorges and breaks are found rough shepherds' huts, the *stanni* of local appellation. Near the summits and the crested ridges, the built-up type of habitation gives way to the natural cavern or grotto, a not infrequent characteristic of this karst-like district.

The zone immediately below is that of the hilly country fringing the mountainous area. It extends over the best part of central Albania and rarely rises above 2,300 feet (700 meters). In its northern section it is characterized by a type of stone house which is well developed in the valley of the Tirana River. The lowest reaches of the zone contain the *chiflik,* or ranch type of habitation, consisting of a dwelling built centrally with reference to its appurtenances of fields and orchards. This zone is favorable for corn growing as well as for olive and tobacco cultivation.

The *chiflik,* however, is more typical of the succeeding zone, which is essentially a farming region of plains and valleys. The Musakia valley and the plain of Elbassan, a former lake-bed, are characteristic districts of the zone. Practically each valley has its urban center, sometimes—though this is exceptional—with a population as great as from five to ten thousand souls.

The last zone consists of the coastal strip of Albania. It is not thickly populated except around the ancient harbors. Sand dunes have often proved an obstacle to settlement. As a rule trade has fostered occupancy of the region, and the chief centers are found at the heads of the natural land routes, which, in antiquity, reached the heart of the Balkans by way of exceedingly arduous lines.

AFRICA

New Evidence on the Age of the Zimbabwe Ruins of Rhodesia. Dr. Randall-MacIver's theory ("Mediaeval Rhodesia," London, 1906) on the age of the Zimbabwe ruins is supported by a new line of evidence brought forward by the Rev. Samuel S. Dornan (Rhodesian Ruins and Native Tradition, *South African Journ. of Sci.,* Vol. 12, No. 11, 1916). In opposition to the theory advocated especially by R. N. Hall ("Prehistoric Rhodesia"), wherein the ruins are accredited with an age not later than 900 A. D. and attributed to Semites or Semitic influence, the former theory makes them of medieval or post-medieval age and of Bantu origin, reduces them in fact to the "level of a glorified Kafir kraal." Heretofore evidence has been solely archeological. Because of the difficulties of obtaining it, native tradition has been supposed lacking and its possibilities ignored. Mr. Dornan points out that natives now living in the vicinity of the ruins are not necessarily those who know the most about them. Within the last three hundred or five hundred years the population of Rhodesia has seen many changings and shiftings as a result of migrations of tribes from across the Zambesi and of more recent Zulu incursions. By means of patient investigation among the Makaranga tribe several traditions have been secured, and these confirm the supposition that Zimbabwe was "built by natives, inhabited by natives, and recently abandoned, probably not more than three hundred years ago."

Pastoral Control in the Transkei Territories of the Cape Province. A sudden crisis or catastrophe in the life of a people affords a test of the strength of the geographic controls by which it is governed. Three times within the last sixty years such a test has demonstrated the high importance of the pastoral control among the natives of the Transkei Territories in the eastern part of the Cape Province (Rev. J. R. L. Kingon: The Economics of the East Coast Fever as Illustrated by the Transkeian Territories, *South African Journ. of Science,* Vol. 12, No. 6, 1916).

In the middle of the last century the extraordinary delusion of the rebellious Amaxosa, involving the slaughter of their entire herds, led to the death or emigration

of thousands. At the end of the century rinderpest carried off ninety per cent of the cattle and entailed proportionate suffering on the populace, and now, during the last few years the territories have been swept by another fatal cattle disease, the East Coast fever. The loss has been tremendous. Some idea of its magnitude may be gained from the fact that 23 out of the total of 27 districts have been involved and that in the five of them alone from which official estimates are forthcoming the direct loss in cattle has been placed at £1,250,000.

But this represents only a portion of the financial loss, and the effects of the disaster have permeated the whole physical and mental as well as the economic life of the people. With mealies and Kafir beer, milk forms the staple of native diet. Reduction of the milk supply produced an immediate effect in increased infant mortality. It also put a strain on agricultural resources, as yet little developed for a people who number 50 to the square mile. Moreover, both allied and unconnected events combined to diminish even the usual productivity of the land. Manure was lacking and cattle were unavailable for ploughing and the consequences of shallow planting magnified the effects of the serious drought that obtained during 1912. The native farmer, with his harvest commonly pledged for former debts, was thus compelled to buy back necessities at exorbitant prices. In addition, the dislocation of traffic impeded help that might otherwise have been forthcoming. Although the railroad mileage is being extended and motor vehicles are entering into general use, the ox-cart still remains the ordinary medium of transportation. The shortage of oxen and still more the stringent regulations created to prevent the spread of infection paralyzed communication.

Again, cattle constitute the native savings bank: they are the common form of investment. With their decrease not only was the purchasing power of the people curtailed but debts could not be paid and morality suffered. The moral effect penetrated deeper. The ceremony of marriage requires a payment in cattle by the bridegroom to the father of the bride. In cases where the requisite number of cattle could not be obtained immoral relations were apt to result, though, on the other hand, the practice of polygamy was greatly curtailed. Yet the consequences of the plague were not wholly evil: one may note the effect on education. By it many herd boys were set free for unwonted schooling. Native relations with the Government were not so happy. Measures to cope with the epidemic naturally fell heavily upon individuals and were often misunderstood. Police duty was increased, and in extreme instances military force had to be employed.

It is not improbable that this blow to pastoral life may favorably influence the new agricultural movement that is already being felt in the territories (Rev. J. R. L. Kingon: Native Agriculture, *South African Journ. of Science,* Vol. 12, No. 5, 1915.) It is true that the native has been and still is very wasteful. He has destroyed much of the original forest and its animal population. In his cultivation he clings to the old tribal customs. His staples—mealies, Kafir corn, pumpkins, beans, and sugar-cane —are sown together, broadcast and indiscriminately; ploughing is seldom done to an adequate depth; rotation of crops is not followed and irrigation is scarcely developed, in spite of the liability of droughts such as that of 1912. Underlying many of the native practices one still finds the old fear of witchcraft. Many yet attribute a good harvest to a good ''medicine'' rather than to proper cultivation. But the spread of agricultural education and the change in land ownership encourage hope for the gradual transformation of the primitive tribal ideas and methods. As the Government surveys progress land is gradually passing from communal to individual tenure, the practice of enclosure is growing, and with it the possibilities of better agriculture.

ASIA

A Numerical Estimate of the Christians of the Turco-Persian Border. Attention to the plight of the inhabitants of the Turco-Persian boundary zone has recently been attracted by the outrages to which they have been subjected through the lawlessness prevailing in the region. Thanks to the zeal of missionaries stationed at various points in the valley of the Tigris and in the lake region of the Armenian highlands it is now possible to reach a likely estimate of the number of the Assyrian Christians, more frequently referred to as Nestorians, and related groups. The statistics derived from native sources by missionary efforts have been collected recently by Dr. W. W. Rockwell in a pamphlet entitled ''The Pitiful Plight of the Assyrian Christians in Persia and Kurdistan,'' published by the American Committee for Armenian and Syrian Relief, New York, 1916. According to this document the Christian element in the valley of the Tigris around Mosul comprises twelve thousand families aggregating 71,652 inhabitants. The majority consists of Roman Catholic Uniats. An important group is made up of Jacobites, some 11,400, who are descendants of the followers of the church organized by

Jacob Baradai in the second half of the sixth century. Four thousand of these Christians are Nestorians.

In the highlands of Kurdistan the 92,000 tribal or semi-independent Christians are mainly Nestorians. The largest community occupies the Tyari region. On the Persian side, in Adarbaijan, between 30,000 and 35,000 Christians are scattered in the Lake Urmia region, especially in the valleys of the three short rivers which empty into the lake from the west. Altogether the number of Assyrian Christians is estimated at 198,452. In this aggregation 115,800 recognize the Mar Shimun, or patriarch of the Nestorians, as their leader.

Sir Aurel Stein's Latest Expedition in Central Asia. In the August and September, 1916, numbers of the *Geographical Journal* Sir Aurel Stein outlines the main results of his latest expedition, conducted on behalf of the Indian Government in the western Gobi, Chinese Turkestan, the Pamirs, and Seistan in eastern Persia. During the two and a half years so spent (August, 1913, to February, 1916) the explorer traveled over 11,000 miles, acquired a rich archeological collection and much material of geographical and historical interest, and with his assistants surveyed and mapped some hundreds of square miles of territory, part of which had never before been seen by European eyes. Notices of the earlier operations of the expedition have appeared in the *Bulletin of the American Geographical Society* (Vol. 46, 1914, pp. 531 and 771; Vol. 47, 1915, pp. 533 and 774-775). They extend from the start of the expedition in Kashmir to its most easterly field in the Pei-Shan Gobi of southwestern Mongolia. Some of the important events of the later journeys are here summarized.

November, 1914, saw Sir Aurel and his assistants in the depression of Turfan in the northeastern corner of Chinese Turkestan. Much detailed research was carried out here, for, as is well known, this basin, like its larger counterpart, that of the Tarim, is of critical importance in the interpretation of climatic change and human relations. With this in view a detailed survey was made on the scale of one mile to the inch. Several excavations were conducted, one at Idikut-shahri, long ago identified as the site of Kao-chang, the capital of Turfan in the seventh to eighth centuries A. D., when the region was an important Chinese administrative center and a great trading place between China and Western Asia. In Turfan the explorer was joined by his surveyor Lal Singh, who had carried his triangulation to the vicinity of Lou-lan in the Lop Desert. Later Lal Singh connected this work with that done in the Kwen-lun and thence via the Kuruk-tagh with surveys in the Tien-shan.

Striking south by the now unpopulated country of the rugged Kuruk-tagh, Sir Aurel followed the line of oases along the southern base of the Tien-shan to Kashgar. His archeological finds convinced him that the area under cultivation in Buddhist times was in excess of the present irrigation resources, which he carefully measured. The Kashgar River was pursued to its western headwaters and the divide crossed to the Alai valley, on the old road of the Chinese silk traders to the Oxus. Thence a little-known route was selected southward across the Pamir plateau over great glacier-clad ranges presenting valuable data on recent glacial retreat. From Lake Victoria, in the heart of the Pamirs, the famous legendary source of the four great rivers of Asia, the upper Oxus valley was followed on the Russian side. In the region inhabited by the Wakhis modern economic development claimed attention on account of the material progress made by these people, now secure alike from Kirghiz raids and Afghan exactions.

From the upper Oxus rapid marches through Bokhara brought Sir Aurel to Samarkand and the Russian Central-Asian railway, on which he proceeded to Ashkabad on the border of the Persian plateau. Crossing this southward he arrived in November, 1915, in Seistan, the self-contained basin on the Persian-Afghanistan boundary, a plane-table survey on the scale of four miles to an inch being made en route. In Seistan discoveries of Buddhist remains proved the previously suspected Iranian link connecting the Greco-Buddhist art of northwestern India with the Buddhist art of Central Asia and the Far East. From Seistan the return to India was made through the Baluchistan desert: Srinagar was reached in the middle of March. There the vast amount of archeological material collected will undergo preliminary examination and arrangement prior to removal to its permanent home in the Museum of Indian Art and Ethnography at Delhi.

Rainfall and Crops in India. Increasing attention is being paid to relations between weather and crops. This is a practical application of meteorological data which suggests many future economic possibilities. In India, with its dense population and its extremely critical monsoon rainfall, much interest is naturally taken in such investigations. A recent number of the *Memoirs of the Indian Meteorological Department* (Vol. 21, Part 14, 1916) contains a discussion of the correlation of rainfall and the succeeding crops, with special reference to the Punjab, by S. M. Jacobs. The area selected for study, in the Doab, between the rivers Beas and Sutlej, has no canals and, as a rule, very little flooding. The problem of rainfall effect is, therefore, comparatively

simple. It is clearly recognized that the complexity of the question of forecasting the crop is very great. The area sown, for example, is determined by such factors as the price of seed, labor, population, mortality, standard of living, and political changes. Nevertheless, unless the fluctuations of these contributing causes are unusually large, the rainfall control stands out clearly enough. The determination of the yield per acre is less of an economic problem and more purely one of meteorology, soil physics, and plant biology.

The predictions thus far made of the sown area show a distinctly close correspondence between observed and calculated results, the probable error being 5.6 per cent of the mean. The predictions of the crop, based on a formula developed by the author, show a close agreement with the actual conditions. The author concludes that this method of correlation makes it possible "to establish prediction formulæ of both sowings and yield which represent with accuracy the effect rainfall has on crops." While the formulæ might "undoubtedly be improved," they already have a practical value "which modern statesmanship cannot afford to ignore." R. DeC. Ward.

AUSTRALASIA AND OCEANIA

Upper Air Research in Australia. The first report on upper air research in Australia has been published (*Commonwealth Bureau of Meteorol. Bull. 13*, Melbourne, 1916). Difficulties have been encountered owing to the fact that Melbourne is on the south coast of Australia and the prevailing winter winds, as well as the upper currents in advance of cyclonic disturbances, are from a northerly direction, and thus carry the balloons out to sea. The work has been greatly curtailed because of the war and the consequent enlistment of many officers with the Australian Imperial Forces. The first ascents of *ballons sondes* were made in 1913, and there were fifteen in all, ending in May, 1915. The balloon track and the accompanying weather conditions are charted for each ascent, together with "altitude-graphs" showing the temperatures recorded. The general conditions for this work have been so unfavorable that nothing but preliminary results are to be expected. The mean height of the "isothermal layer," or stratosphere, above Melbourne is 10 kilometers. R. DeC. Ward.

Extension of the Boundaries of the Gilbert and Ellice Islands Colony. The *Board of Trade Journal* for May 25, 1916, reproduces an Order-of-Council dated January 27, 1916, from the *London Gazette* of May 19, according to which the boundaries of the Gilbert and Ellice Islands Colony are extended so as to include Ocean Island, immediately west of the group, and Fanning and Washington Islands, several degrees to the east. A later order, dated February 29, effected the further annexation of the Union Islands to the southeast, with all small islands, islets, rocks, and reefs depending on them, to the Gilbert and Ellice Islands Colony. A notice concerning the original group appeared in the February, 1916, number of the *Review*, p. 145.

PHYSICAL GEOGRAPHY

The Melting of Snow. A study of the melting of snow at Albany, N. Y., has been made by Mr. Robert E. Horton. The period of observation covered February-March, 1914, and the changes in depth, density, and water-equivalent of the snow accumulation were noted. The subject is an important one for engineers, as well as for meteorologists. A number of conclusions are reached, among which a few may here be noted. If snow melts at the surface, or if warm rain falls on it, most of the water percolates down through the body of the snow, provided the latter is at about 32° Fahrenheit, and a part of the water adheres to the snow crystals as a capillary film. When snow overlies unfrozen ground, or frozen but porous and unsaturated soil, most of the water from melting percolates to the bottom of the snow layer, and thence into the soil. The melting of snow or warm rain falling upon a snow cover under suitable conditions is thus more favorable to the replenishment of ground water than would be an equal volume of rainfall on a bare surface, since, in the presence of snow, surface run-off is greatly retarded and the opportunity for infiltration increased. Under suitable conditions, especially in woods where the ground is least frozen, a deep layer of snow on level ground may wholly disappear by invisible percolation without causing any run-off whatever (*Monthly Weather Rev.*, Vol. 43, 1915, pp. 599-605). R. DeC. Ward.

The Origin of Cyclones and Anticyclones. In a recent paper on "The Local Circulation of the Atmosphere" (*Monthly Weather Rev.*, 1916, pp. 182-186), W. H. Dines concludes that the known relationships between pressure and temperature are explicable on simple dynamic principles if the disturbance is supposed to start at 8 or 9 kilometers and to spread downward, resulting in the production of the familiar surface

phenomena. It is not yet clear how the upper winds which blow around a certain region start, or strengthen, or cease. But it is certain that, however a low-pressure area is produced, it is not due to the high temperature of the air above it. R. DeC. Ward.

GEOGRAPHICAL NEWS

Personal

Mr. Edgar J. Banks, field director of the Babylonian Expedition of the University of Chicago to Bismaya, gave a lecture on December 8, 1916, before the Geographic Society of Chicago entitled "A Thousand Miles down the Tigris River."

Mr. C. William Beebe, curator of ornithology of the New York Zoölogical Society, read a paper on December 18, 1916, before the New York Academy of Sciences on "Zoölogical Studies of British Guiana."

Professor A. P. Brigham of Colgate University will give two courses at the coming Summer School session at Columbia University: (1) Geographic Influences in American History; (2) Geography of New York State.

Professor Nathaniel L. Britton, director-in-chief of the New York Botanical Garden, on the occasion of the annual meeting of the New York Academy of Sciences on December 18, 1916, presented a report on the progress of the natural history survey of Porto Rico which is being conducted under the auspices of the New York Academy of Sciences (see *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 210-211).

Mr. Henry G. Bryant, president of the Geographical Society of Philadelphia, on the occasion of the celebration, on December 6, 1916, of the twenty-fifth anniversary of the founding of the society, addressed the members on "Men and Members of the Early Days of the Society."

Professor Reginald A. Daly of Harvard University read a paper at the twenty-ninth annual meeting of the Geological Society of America at Albany, December 27-29, 1916, on "New Test of the Subsidence Theory of Coral Reefs."

Professor Elizabeth F. Fisher of Wellesley College gave an illustrated lecture on November 28, 1916, before the Appalachian Mountain Club of Boston on "The Contrasted Scenery of the Sierra Nevada and Rocky Mountains."

Professor J. Paul Goode of the University of Chicago gave a lecture on January 3 before the Geographical Society of Philadelphia on "The Geographic Causes of the Great War."

Professor D. W. Johnson of Columbia University addressed the Germanistic Society of America on December 15 on "Topographic Features as an Influence in the European War" and the American Philosophical Society of Philadelphia on January 5 on "The Strategic Geography of the Balkan Campaign."

Mr. Charles Keyes read a paper at the twenty-ninth annual meeting of the Geological Society of America at Albany, December 27-29, 1916, on the "Orographic Origin of Ancient Lake Bonneville."

Professor E. M. Lehnerts of the University of Minnesota will give two courses at the coming Summer School session at Columbia University: (1) Map Interpretation; (2) Field Work in Physiography (in the metropolitan district and Hudson River region).

Professor Harry Fielding Reid of Johns Hopkins University read a paper at the twenty-ninth annual meeting of the Geological Society of America at Albany, December 27-29, 1916, on "Geometric Plans of the Earth, With Special Reference to the Planetesimal Hypothesis."

Dr. Herbert J. Spinden of the American Museum of Natural History read a paper on December 18, 1916, before the New York Academy of Sciences on "Ethnic Relations between Venezuela and Porto Rico."

Professor Frederick Starr, associate professor of anthropology at the University of Chicago, lectured on November 10, 1916, before the Geographic Society of Chicago on "Aztec Mexico."

Mr. Norman Taylor of the Brooklyn Botanic Garden announces a course on phytogeography at that institution. The course will deal with plant distribution. Prerequisites are courses in plant ecology and geology and a good general knowledge of climatology and systematic botany.

Dr. Talcott Williams, director of the School of Journalism of Columbia University, on the occasion of the celebration, on December 6, 1916, of the twenty-fifth anniversary of the founding of the Geographical Society of Philadelphia, addressed the members on the "Past and Future of the Society."

GEOGRAPHICAL PUBLICATIONS
(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

United States

General

Henry, A. J., chairman, E. H. Bowie, H. J. Cox, and H. C. Frankenfield (Board composed of). **Weather forecasting in the United States.** 370 pp.; maps, diagrs. *Weather Bur.* [*Publ.*] *No. 583.* U. S. Dept. of Agric., Washington, D. C., 1916.

The study of the atmosphere began when primitive man observed the local weather signs. These he used as prognostics, in foretelling coming weather changes. Gradually a collection of weather proverbs was built up, and today, in spite of the "official" forecasts, all of us still depend more or less upon local signs and prognostics. As in the earliest days, so now, weather forecasting is the aspect of atmospheric study which has the widest popular interest. It is the immediately practical human aspect of meteorology and for that reason appeals to every one. Thus it is natural that any published discussion of weather forecasting should attract attention.

The present volume is the outgrowth of a desire on the part of the Weather Bureau to bring together the principles which have guided the official forecasters in their daily work, in order that the experience of those who have gone before may be available for the guidance of those who are to come after. Various members of the forecasting staff have contributed to the volume, and the whole has been compiled by an editorial board under the chairmanship of Professor A. J. Henry. There have been a good many publications which have treated various aspects of the forecasting problem, especially from the "popular" standpoint, but the present discussion is by far the most complete of them all.

Let it not be thought that this series of discussions on weather forecasting will furnish "interesting reading," in the ordinary meaning of those words. There are too many details, of forms, and movements, and interactions, and characteristics of cyclones and anticyclones, to give the volume the popular appeal which its title suggests. Students of meteorology who desire to make a serious attempt to master the principles of weather forecasting in the United States will find it an invaluable text-book and guide. And others, interested in the pedagogic aspects of the science, will find the carefully selected standard "type" maps very helpful for purposes of illustration and discussion.

Those who read the volume through cannot fail to be impressed with the extraordinary complexity and difficulty of weather forecasting. Here we find the forecasters telling us all their "secrets," and making clear to us just what considerations govern them in their daily work of weather prediction. And here we find, also, many general matters, pertaining to other aspects of meteorology. Thus we read (p. 126): "The observant forecaster can add but little of importance toward clearing up the source of energy of the high . . . . . . It seems reasonable to assume that radiation to space has an important bearing upon the formation and maintenance of highs." The modifying influence of the Great Lakes on cold waves is clearly pointed out (pp. 151-152). The series of type weather maps showing conditions favorable for frost in different sections of the country (Figs. 101-124) and of snow and sleet types (Figs. 163-170) are especially noteworthy. The conclusion is reached (p. 202) that "a dew point reading in the evening is no indication of the ensuing minimum temperature." In the discussion of fog forecasts there are two *new* text figures showing fog frequency on the Atlantic and on the Gulf coasts (Figs. 171, 174). The chapter on long-range forecasts contains the none too emphatic statement "That there is not at this time, nor is it probable that there will be in the near future, a sound basis for such forecasts is . . . unquestionably true," with, it may be added, the notable exception of the Indian monsoon forecasts. Reference is made to the now well-recognized importance of the weather controls exercised by "centers of action," and a series of "precepts" is listed (pp. 345-346) which embody the results reached in the Forecast Division regarding the control of the weather in the United States by our neighboring "centers of action." A bibliography of works *in English* dealing with forecasting concludes the volume.

The Weather Bureau has done a good service in having this series of studies of weather forecasting compiled and published. Teachers and students of meteorology, although not directly interested in forecasting, will here find much information about our weather types and phenomena, and, as suggested above, will be able to put to good use the many excellent "type" maps. It is a pity that so valuable a publication should be known officially as "W. B. No. 583"—surely a nondescript designation.

R. DeC. Ward.

James, G. W. **Our American wonderlands.** ix and 297 pp.; ills., index. A. C. McClurg & Co., Chicago, 1915. $2.00. 8 x 5½.

The only map in this volume is an outline on the inside of the cover and on the first fly-leaf locating the places which serve as themes of about thirty chapters which make up the book. The geographer would like to see some local maps included, but perhaps their absence is justified by the author's intention to arouse interest in American scenery rather than to provide a guide book. All the places but three are west of the Mississippi River, a plan supported in part by nature and perhaps fully by the experiences of the author. The three chosen features in the East are the Mammoth Cave, the Natural Bridge of Virginia, and Niagara. It would be easy to enlarge the eastern list and perhaps to improve it without making it larger. It is appropriate that a volume which opens with the Grand Canyon, the masterpiece of nature in America, should close with a waterfall the most studied, the most written about, and the most visited of all phenomena of its class.

The author's choice is not only western, but southwestern. He could not omit Mt. Rainier, Glacier National Park, the Yellowstone, or Crater Lake, but, duty done, he moves southward. Colorado comes off with Pikes Peak, the Garden of the Gods, and Mesa Verde, but Utah perhaps would like to add to her natural bridges the story of her Wasatch and of her Great Salt Lake, with its wonderful history. California, New Mexico, and Arizona claim major places in the author's appreciation, and the choice in some cases betrays his favoritism. But the purpose is worthy—while war shuts Americans from too exclusive visits across the sea, to open to them the greater natural glories of America. James thinks also that the cliff dwellings are as fascinating as Rhine castles, and the Hopis, Apaches, and Navajos more picturesque than the peasants of Switzerland, Ireland, or Russia. The volume is illustrated with about one hundred and fifty views, and the text is vivacious and interesting.

A. P. Brigham.

Bailey, L. H. **The forthcoming situation in agricultural work—II.** *Science,* Vol. 43, 1916, Jan. 21, No. 1099, pp. 77-87. [Retiring vice-presidential address, Section M, American Association for the Advancement of Science, Columbus, O., meeting.]

Bauer, L. A. **Work done by the United States Coast and Geodetic Survey in the field of terrestrial magnetism.** *Science,* May 12, 1916, pp. 666-667. [Abstract of an address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

Black, W. M. **The United States Corps of Engineers and its relation to the United States Coast and Geodetic Survey.** *Science,* May 12, 1916, pp. 669-670. [Abstract of an address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

Bowie, William. **The one-hundredth anniversary of the United States Coast and Geodetic Survey: Account of the celebration.** *Science,* May 12, 1916, pp. 655-656.

Burger, W. H. **Contributions of the United States Coast and Geodetic Survey to geodesy.** *Science,* July 7, 1916, pp. 4-11. [Address given at the centennial exercises of the Survey.]

—— **Climatological data for the United States by sections: Year 1915** (Vol. 2, No. 13). 346 pp.; maps. *U. S. Weather Bur. [Publ.] No. 576.*

—— **Cotton production in the United States: Crop of 1915.** 28 pp. Bur. of the Census, Dept. of Commerce, Washington, D. C., 1916.

Faust, A. B. **Swiss emigration to the American colonies in the eighteenth century.** *American Hist. Rev.,* Vol. 22, 1916, No. 1, pp. 21-44. [Essay based on material in Swiss archives on the distinctive features of Swiss emigration: (1) governmental obstruction at home, (2) social ostracism, (3) deprivation of all rights and privileges. Also a record of important Swiss colonial expeditions to America, chiefly to South Carolina and Pennsylvania.]

—— **Geographic Board, United States, Fourth report of the, 1890 to 1916.** 335 pp. U. S. Geographic Board, Washington, D. C., 1916. [Contains the official spelling of all names passed on by the board since its inception.]

Grosvenor, G. H. **The land of the best: (A tribute to the scenic grandeur and unsurpassed natural resources of our own country).** Ills. *Natl. Geogr. Mag.*, Vol. 29, 1916, No. 4, pp. 327-430. [Remarkable photographs, many of which are of geographic value.]

Grover, N. C., A. H. Horton, and W. E. Hall. **Surface water supply of the United States, 1914. Part 3: Ohio River basin.** xxxii and 125 pp.; ills., index. *U. S. Geol. Survey Water-Supply Paper 383.* Washington, D. C., 1916.

Hazard, D. L. **Results of magnetic observations made by the United States Coast and Geodetic Survey in 1915.** 80 pp. *U. S. Coast and Geod. Survey Special Publ. No. 36.* Washington, D. C., 1916.

—— **Highways, National, and good roads everywhere.** 49 pp.; maps, ills. National Highways Assoc., Washington, D. C., 1913.

James, J. A. **Some phases of the history of the Northwest, 1783-1786.** *Proc. Mississippi Valley Hist. Assoc. for the Year 1913-14,* Vol. 7, pp. 168-195. [A discussion of the relation of George Rogers Clark to some of the phases of Western history during the three years after the declaration of peace.]

Johnson, D. W. **The contribution of the United States Coast and Geodetic Survey to physical geography.** *Science,* May 12, 1916, pp. 673-674. [Abstract of an address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

Jones, G. M. **Government aid to merchant shipping.** 265 pp.; index. *Bur. of Foreign and Domestic Commerce Special Agents Ser. No. 119.* Dept. of Commerce, Washington, D. C., 1916.

Joseph, Samuel. **Jewish immigration to the United States from 1881 to 1910.** 209 pp.; bibliogr. *Columbia Univ. Studies in Hist., Econ. and Public Law,* Vol. 59, 1914, No. 4. Longmans, Green & Co., New York, 1914. $1.25. 10 x 6½. [For extended review, see article ''Our Immigrant Problem,'' by Ellsworth Huntington in the December, 1916, *Review,* pp. 458-463.]

La Flesche, Francis. **Protection of Indian lands.** *Rept. of the 33rd Ann. Lake Mohonk Conference on the Indian and Other Dependent Peoples, Oct. 20, 21, and 22, 1915,* pp. 70-72.

Littlehales, G. W. **Hydrography and charts, with special reference to the work of the United States Coast and Geodetic Survey.** *Science,* May 12, 1916, pp. 670-671. [Abstract of an address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

Macfarlane, J. J. **American trade in 1915.** Diagrs. *Commerc. America,* Vol. 12, 1916, No. 11, pp. 9, 11, 13, and 15.

McWilliams, R. F. **Our neighbors of the south.** *Proc. Mississippi Valley Hist. Assoc. for the Year 1913-14,* Vol. 7, pp. 334-346. [Comparison, by a Canadian—hence the title—of the development of the Canadian West and the Northwest of the United States.]

Mendenhall, T. C. **The one hundredth anniversary of the U. S. Coast and Geodetic Survey.** *Science,* July 14, 1916, pp. 45-50. [Address given at the centennial exercises of the Survey.]

Moore, J. H. **The United States Coast and Geodetic Survey's part in the development of commerce.** *Science,* May 12, 1916, pp. 667-669. [Abstract of an address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

Pillsbury, J. E. **Ocean currents and deep-sea explorations of the United States Coast and Geodetic Survey.** *Science,* May 12, 1916, p. 667. [Abstract of an address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

Poor, C. L. **Oceanic tides, with special reference to the work of the United States Coast and Geodetic Survey.** *Science,* May 12, 1916, pp. 672-673. [Abstract of an address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

North Atlantic States

Comstock, Sarah. **Old roads from the heart of New York.** xxiv and 401 pp.; ills., index, bibliogr. G. P. Putnam's Sons, New York, 1915. $2.50. 9 x 6.

Belongs to the type of gossipy historical annals, but is based on ample historical knowledge and attractively illustrated. The ancient roads are followed in a diffuse way, and sometimes with a superabundance of anecdote, into Long Island and Staten Island, westward into New Jersey and northward along the Hudson.

There are two folding maps, one of the date 1828, ''showing the country thirty miles

round the City of New York,'' and a larger map of the same area drawn for this volume. This map shows the railroads and trolley lines, with sufficient fullness of names to make the map a useful guide to the text. For a student already familiar with the lore of Old New York and with leisure for many short journeys the book is a helpful companion. To the general reader, with small local knowledge, the work makes a less effective appeal.

There are about one hundred half tone views, a good chapter of ''easy routes for the traveler of today,'' and a bibliography of more than one hundred titles.

A. P. BRIGHAM.

GOODNOUGH, X. H. **Rainfall in New England.** Map, diagrs. *Journ. New England Water Works Assoc.*, Vol. 29, 1915, pp. 237-438. Boston.

Mr. Goodnough's paper is one of the many that appear in the *Journal of the New England Water Works Association* and that deserve the careful attention of meteorologists and climatologists. Most of it consists of a full series of tables showing the monthly rainfall in New England and at a few neighboring stations. No previous tables have embraced so many records in addition to those made under the direction of the U. S. Weather Bureau.

In his text Mr. Goodnough gives a new map of rainfall in New England. It shows with great clearness the effect of relief in causing abundant rainfall at high altitudes and on the eastern side of the main highlands. It also emphasizes the diminution of rainfall from the coast inland. A series of diagrams emphasizes another and much less commonly recognized contrast between the coast and the interior. On the coast the rainfall in summer is decidedly less than in winter, for New England is only a little north of the latitudes where subtropical summer droughts prevail in large parts of the world. Even a hundred miles inland, however, the summer indraft and winter outdraft due to continental heating and cooling cause a reversal, so that summer rains much exceed those of winter. All over New England the summer rainfall is almost the same, which is good for agriculture, but the winter rainfall, which is of chief importance in determining the value of a water supply for city use or for power, varies a good deal from the favored coast to the less favored interior.

Mr. Goodnough also discusses the question of periodicity in rainfall. He agrees with other observers in finding no regular period, but he is impressed by the fact that periods of ten or fifteen years sometimes have a rainfall quite persistently above or below normal. He also calls attention to the fact that during the first half of the last century severe droughts seem to have been more frequent than during the second half.

ELLSWORTH HUNTINGTON.

BLACK, G. F. **List of works in the New York Public Library relating to the geology, mineralogy, and palæontology of New Jersey.** *Bull. New York Public Library*, Vol. 20, 1916, No. 6, pp. 501-525.

DUBLIN, L. I. **Factors in American mortality: A study of death rates in the race stocks of New York State, 1910.** Diagrs. *Amer. Econ. Rev.*, Vol. 6, 1916, No. 3, pp. 523-548.

GOLDTHWAIT, J. W. **Glaciation in the White Mountains of New Hampshire.** Map, diagr. *Bull. Geol. Soc. of Amer.*, Vol. 27, 1916, No. 2, pp. 263-294. [The author concludes that Alpine glaciation in the White Mountains took place *before* the last advance of the continental ice sheet. The local glaciers were probably confined to favorable situations on the sides of the peaks which exceed 4,500 feet elevation, and continued long enough to carve out well-defined cirques. The ensuing ice sheet, which moved from northwest to southeast, obliterated all local valley moraines, but spared the cirques at the heads of the ravines.]

GREENE, NELSON. **The story of old Fort Plain and the middle Mohawk Valley.** xv and 399 pp.; maps. O'Connor Brothers, Fort Plain, N. Y., 1915. $1.50. 9 x 6½. [''A review of Mohawk Valley history from 1609'' to the present, ''treating particularly of the central region comprised in the present counties of Herkimer, Montgomery, and Fulton.'']

GUERNSEY, S. J. **Notes on explorations of Martha's Vineyard.** Map, diagrs., ills. *Amer. Anthropologist*, Vol. 18, 1916, No. 1, pp. 81-97. [Archeological survey near Gay Head.]

—— **Iroquois Indian groups of the New York State Museum, The.** *Science*, June 16, 1916, pp. 844-846.

KATZ, F. J. **Note on a moraine in northwestern New England.** *Science*, July 21, 1916, p. 102.

MAXON, E. T., AND W. R. CONE. **Soil survey of Clinton County, New York.** 37 pp.; maps. Bur. of Soils., U. S. Dept. of Agric., Washington, D. C., 1916.

Sealey, D. A. **Rapid transit work in 1915, New York City.** Maps. *Engineering News*, Vol. 75, 1916, No. 18, pp. 842-849.

Skerrett, R. G. **A difficult piece in subaqueous rock excavation.** Map, ills. *Scientific American*, Sept. 9, 1916, pp. 235 and 247. [Coenties Reef is the chief stumbling block to navigation in the East River. Under it will pass the Whitehall-Montague St. tunnel connecting Manhattan and Brooklyn.]

Wells, J. P. **Record flood from melting snows passes through Rochester, N. Y.** Maps, diagr., ills. *Engineering Rec.*, Vol. 73, 1916, No. 15, pp. 476-478.

EUROPE

British Isles

Martin, E. A. **Dew-ponds: History, observation, and experiment.** 208 pp.; ills., index. T. Werner Laurie, Ltd., London, [1915?]. 6s. 7½ x 5.

Situated on the downs of England and notably in the region of Kent and Sussex there are a number of small ponds which, because they hold water even during long dry periods, have attracted special attention. These ponds are higher than many that are entirely evaporated or that dry up during a prolonged drought.

Mr. Edward A. Martin questioned the efficiency of dew in the replenishment of these ponds, and therefore took up an elaborate study of them in the hope of arriving at a safe conclusion as to their source of water supply. Many of the more noted of the dew-ponds were carefully watched. Thermometers were placed in and about the ponds. Observations as to the rainfall, amount of dew, humidity, and fogs in the vicinity of the downs were made. Finally a special pond was constructed for experimental purposes.

From the historical standpoint, these ponds have a special interest, for it is believed that they may date back to the time of Neolithic and possibly of Paleolithic man. They now supply drinking water for stock, and possibly they may have been the source of water for early peoples living upon these downs. They are located in the region of the chalk beds, and the puddled chalk is efficient in preventing waters from sinking readily into the ground. They have in some cases been constructed with great care, and layers of straw have been interbedded with rocks and clays. The experiments and observations carried on by Mr. Edwards convinced him that the ponds are not replenished by the formation of dew upon the water surface, nor by the formation of dew on the lands or shrubbery about the ponds. He has found that the amount of dew which forms upon the downs is quite insufficient to account for the perennial nature of these higher ponds. The mists and fogs, however, which are very common and which render the vegetation about the ponds "wringing wet," must be important factors in supplying water upon the downs; and these, with the help of rainfall, must account for the replenishment of the water supply. It would seem more appropriate to use the term "mist-pond" rather than "dew-pond."

W. W. Atwood.

Perris, G. H. **The industrial history of modern England.** 603 pp. Henry Holt & Co., New York, 1914. $2.00. 7½ x 5.

A book by an economist who has dug deep into his material, and handled it well from the scientific standpoint. He also has a pleasing element of the dramatic in his writing. He thinks the world once suffered greatly from *a priori* philosophizing, and his aim is "to state and classify facts, not to deduce eternal and immutable laws."

He thinks the hundred and fifty years from 1760 to 1910 are a veritable alp in the plain of human history. This period falls into three parts, divided by 1815 and 1850—dissolution, stagnation, and reconstruction. He shows himself a modern in that he sees the reconstruction not primarily by *men*, but by forces. "England has been fundamentally remade . . . . . . The greatest of those governing personages with whom the historians are mainly concerned look small in the perspective of this mighty change. Its sheer violence overclouds most of our story. The individuals who emerge mimic the tumult of the impersonal forces that drive them on, shouting as the Wagnerian hero must shout through an orchestral whirlwind."

Mr. Perris shows his kinship to the geographer who believes that man's environment made him. In fact he simply carries the point on into an environmental detail—a man's occupation. "As surely as the dyer's hand shows his trade does the technique of every industry, from the simplest to the most complex, reflect itself, not only in the individual, but in the collective and social character of the workers."

The book ends with an acceptance of the doom of perpetual change, while we continue to discover new powers in nature. "The industrial revolution has no beginning and no

end." There are thirty-three pages of appendices giving useful facts and figures on British production, population income, foreign trade wages and prices.

J. RUSSELL SMITH.

ARMSTRONG, J. S., JR. **Bristol.** *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 19j, pp. 1-11. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

BISSOLI, LUIGI. **Problemi di geografia commerciale conseguenti alla coscrizione militare inglese.** *L'Esplorazione Commerc.*, Vol. 30, 1915, No. 12, pp. 441-445.

D[INES], J. S. **Atmospheric pollution in English and Scottish towns.** By J. B. C. Kershaw. *Monthly Weather Rev.*, Vol. 44, 1916, No. 3, p. 114. [Reprinted from *Science Abstracts*, Sect. A, Jan. 31, 1916. See also note in October, 1916, *Review*, p. 307.]

HATHAWAY, C. M., JR. **Hull.** *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 19j, pp. 11-28. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

McCUNN, J. N. **Glasgow.** *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 19i, pp. 1-10. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

MACMILLAN, H. R. **Notes on state forestry in Ireland.** *Forestry Quarterly*, Vol. 14, 1916, No. 3, pp. 461-466. ["Ireland, alone of the four divisions of the United Kingdom, has made an organized beginning in state development of forestry. That this should be so is one of the fruits of the remedial land legislation of the last two decades."]

SMITH, ALEXANDER. **A summer in Skye.** With introduction by W. F. Gray. xviii and 574 pp.; ills., index. W. P. Nimmo, Hay, & Mitchell, Edinburgh, 1912. 8 x 6.

STRAHAN, AUBREY, N. F. MACKENZIE, H. R. MILL, AND J. S. OWENS. **The investigation of rivers: Final report.** 93 pp.; maps, diagrs. *Royal Geogr. Soc. Special Publ.* London, 1916.

WADDELL, P. H. **Troon agency [Scotland].** *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 19i, pp. 10-12. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

ASIA

INDIA

MUNSON, ARLEY. **Kipling's India.** xii and 204 pp.; ills., index. Doubleday, Page & Co., Garden City, N. Y., 1915. $1.50. 9½ x 6½.

A delightful journey from Bombay to Mandalay via Simla, the Khyber Pass, the Ganges plain, Calcutta and Rangoon, described, with the help of many quotations from Kipling and numerous excellent photographs, by one who knows India at first hand and has the ability to make lively pen pictures.

Doctor Munson has rendered a fine service to general readers in giving most of Kipling's India stories a geographical setting. Yet the setting is not complete unless the reader has an atlas at hand, for the book lacks a much-needed map. If the author herself had made greater use of a map she would not have Simla "on the northeastern border [of India] among the Himalaya Mountains."

The book will lead those who know their Kipling to reread his India stories in the light of their surroundings with enhanced pleasure. It will induce the uninitiated, if there be such, to make friends with this master of the art of story telling and his entrancing characters. Some may say that an attempt to so interpret Kipling's India will dispel his remarkable magic and mystery of atmosphere. But those who are geographically inclined will gladly welcome the attempt to give the stories a habitation.

Geographers, and perhaps others, would wish less space given in the book to the background of racy stories of Anglo-Indian social life and more to the setting of the tales of native life. However, as it is, there is much of human geography woven into the journey from where "The Injian Ocean sets and smiles" before Bombay to "the Road to Mandalay."

SUMNER W. CUSHING.

COTTER, G. DE P. **Contents and index of the Memoirs of the Geological Survey of India, Vols. 21-35, 1884 to 1911.** 119 pp. Calcutta, 1916.

DUCHESNE, A. E. **India: A storehouse of empire.** Ills. *United Empire*, Vol. 7, 1916, No. 5, pp. 327-329.

Hayden, H. H. **General report of the Geological Survey of India for the year 1915.** *Records of Geol. Survey of India,* Vol. 47, 1916, Part 1, pp. 1-41. Calcutta.

Holland, T. H. **Quinquennial review of the mineral production of India.** xlvi and 296 pp.; maps, diagrs., index. *Records of Geol. Survey of India,* Vol. 46. Calcutta, 1915.

—— **Plains of northern India, The, and their relationship to the Himalaya Mountains.** *Nature,* No. 2436, Vol. 97, 1916, July 6, pp. 391-393. [''Abridged from an address to the Indian Science Congress at Lucknow on January 13 by the president, Sir Sidney Burrard, F.R.S.'']

Rundall, L. B. **The ibex of Sha-Ping ånd other Himalayan studies.** xiv and 152 pp.; ills. Macmillan and Co., Ltd., London, 1915. $3.50. 10 x 7½. [Big-game hunting in the Himalayas.]

—— **Sind, Sea-borne trade of, in 1915-16.** *Board of Trade Journ.,* No. 1,030, Vol. 94, 1916, pp. 556-557. [Notes that in the Punjab the monsoon of 1915 was much less active than usual, with rain falling only in ''sporadic showers at long intervals;'' consequently the total area sown to crops in 1915-16 was 27 per cent below normal. In Sind, although the inundation of the Indus was one of the lowest recorded, the favorable set of the rivers at the mouths of the irrigation canals maintained the level normal and cultivation as usual.]

—— **Statistical abstract relating to British India. No. 45: 1900-01 to 1909-10,** viii and 288 pp; **No. 46: 1901-02 to 1910-11,** viii and 293 pp.; **No. 47: 1902-03 to 1911-12,** viii and 293 pp.; **No. 48: 1903-04 to 1912-13,** viii and 285 pp; **No. 49: 1904-05 to 1913-14.** Index. *British Parliamentary Papers Cd. 6017, 6637, 7078, 7799, and 8157,* respectively, London, 1911, 1913, 1913, 1915, 1916.

Workman, F. B. **Four miles high.** Ills. *The Independent,* June 5, 1916, pp. 377-378 and 380, 382, 383. [Ascents in the Himalayas.]

Workman, W. H. **The mountaineering aspect of Himalayan glaciers.** Ills. *Alpine Journ.,* No. 210, Vol. 29, 1915, pp. 284-300.

AUSTRALASIA AND OCEANIA

Australia, New Zealand

Cotton, C. A. **The structure and later geological history of New Zealand.** Maps, diagrs., ills. *Geol. Magazine,* Decade 6, Vol. 3, No. 6, 1916, pp. 243-249; No. 7, pp. 314-320.

The author of this paper has recently published an excellent outline of the coastal physiography of New Zealand in the *Review* (''The Fault Coasts of New Zealand,'' Vol. 1, 1916, pp. 20-47). The present paper forms a fitting complement to the earlier one, and, since both are planned in a comprehensive way and represent the latest information, they constitute a standard source of material on the physiography of New Zealand. They deserve special attention on account of the extraordinary variety of forms related to block faulting. It is shown that the skeleton or oldermass of New Zealand is largely composed of sedimentary rocks whose deformation in late Jurassic or early Cretaceous times produced a great mountain range with a geanticlinal structure. But the folds of this oldermass are not now in agreement with the main features of the two chief islands. The shore-line cuts diagonally across the folds, giving the ridges and intervening valleys an *en échelon* arrangement. The strike of the rocks is in general 10° to 15° east of north, while that of the coast is northeast. The coasts themselves have been formed by faulting of very complicated nature, as described in the paper referred to above.

The oldermass was reduced by long-continued erosion to at least moderate relief before the deposit of covering beds (Cretaceous). In places the erosion surface was somewhat hilly when submergence and deposition began, so that some hills survived as islands during a portion of the period in which the sedimentary cover was developed. There followed a period of uninterrupted deposition extending far into the Tertiary. Then came orogenic movements to which the present relief is entirely, or almost entirely, due. This occurred in or about the Pliocene period and was characterized by block faulting, local in its effects. Many of the valleys are tectonic in origin; of like origin are some remarkable intermontane basins drained by rivers that flow out of the basins through deep gorges cut across the oldermass of bordering, upthrown blocks. In some of the uplifted blocks, the surfaces of which were slightly tilted from their former horizontal attitude, remnants may be seen of the fossil denudation plain now exposed

by the erosion of the covering strata. The article is accompanied by a figure which shows a fragment of such a plain in South Canterbury. In places the faulting to which we have referred is so minute and general that the landscape is described as "a mosaic of blocks."

Blatchford, T. **The geology and mineral resources of the Yilgarn goldfield.** 189 pp.; maps, diagrs., ills., index. *Geol. Survey of Western Australia Bull. No. 63*, Part 51, Perth, 1915. [A region midway between Kalgoorlie and Perth in southwestern Australia, with a rainfall under 10 inches a year. Part of the water supply comes from an extension of the well-known Coolgardie scheme, part of it from large reservoirs sunk in the dry watercourses. For the rest, the report consists of detailed notes on the mining geology of the region.]

Brittain, J. I. **Australia.** *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 60a, pp. 1-8. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

Cambage, R. H. **Notes on the native flora of tropical Queensland.** Maps, ills. *Journ. and Proc. Royal Soc. of New South Wales for 1915*, Vol. 49, 1916, Part 3, pp. 389-447. Sydney.

Capra, Giuseppe. **La Vittoria: Il giardino Australe.** 50 pp.; ills. Prem.. Scuola Tip. Calesiana, Milan, 1913.

Cotton, L. A. **Some geo-physical observations at Burrinjuck.** Diagrs. *Journ. and Proc. Royal Soc. of New South Wales for 1915*, Vol. 59, 1916, Part 3, pp. 448-462. Sydney. [Abstracted under the title "A New Experiment on the Strength of the Earth's Crust" in the December *Review*, p. 473.]

Harper, L. F. **Geology and mineral resources of the southern coal-field. Part I—The south coastal portion.** xiv and 410 pp.; maps, diagrs., ills., index. *Memoirs Geol. Survey of New South Wales No. 7.* Sydney, 1915. [The greater part of this memoir is devoted to detailed geology, vulcanology, and petrology.]

Hunt, H. A. **Australian monthly weather report and meteorological abstract: January, 1913.** Maps. *Commonwealth Bur. of Meteorol.* [*Publ.*], Vol. 4, No. 1, pp. 5-60. Melbourne, 1916.

Hunt, H. A. **Australian monthly weather report and meteorological abstract: February, 1913.** Maps. *Commonwealth Bur. of Meteorol.* [*Publ.*], Vol. 4, No. 2, pp. 65-119. Melbourne, 1916.

Magelssen, W. C. **Melbourne.** *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 60a, pp. 8-23. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

Murray, R. A. F. **The Tanjil or Russell's Creek gold-field.** 20 pp.; map, diagrs., index. *Bulls. Geol. Survey of Victoria No. 38.* Victoria, 1916.

Süssmilch, C. A., and W. G. Stone. **Geology of the Jenolan Caves district.** Diagrs., ill. *Journ. and Proc. Royal Soc. of New South Wales for 1915*, Vol. 49, 1916, Part 3, pp. 332-384. Sydney. [With section on physiography.]

Whitelaw, O. A. L., J. P. L. Kenny, and J. G. Easton. **The Mitta Mitta tin and gold-field.** With petrographic notes by D. J. Mahony. 23 pp.; map, diagrs., ills. *Bulls. Geol. Survey of Victoria No. 37.* Victoria, 1915.

WORLD AS A WHOLE AND LARGER PARTS

Banse, Ewald. **Illustrierte Länderkunde.** Herausgegeben unter Mitwirkung von J. Daneš, M. Holzmann, O. Nordenskjöld, und anderen. 335 pp.; map, ills. George Westermann, Braunschweig, 1914. 9½ x 6½.

The title is indeed justified, for there are 64 illustrations that are admirable for beauty and geographic interest, starting off with a view so unusual as that of Mecca. But the point of the book is not in its wonderful pictures nor its geographic descriptions, but in its presentation of the world in fifteen "natural divisions" instead of six continents and two groups of polar lands. Readers of *Petermanns Mitteilungen* will recall Ewald Banse's paper on the Orient (Vol. 55, 1909), conceived as including Persia, Asia Minor, and Arabia, with Africa north of the Sahara, a theme later elaborated in three small volumes (The Atlas Region, The Arabian Orient, The Aryan Orient, B. G. Teubner, Leipzig, 1910). The Orient is the main home of Islam, a unit under many aspects, although it includes parts of two continents. The idea is a good one, for it abandons time-honored but arbitrary notions that hinder progress.

In this volume Banse extends his principles of divisions into natural units to the

whole world. (A preliminary paper, with map, appeared in *Petermanns Mitteilungen* for 1912. The map, substantially the same as that which accompanies the present work, was reviewed in the *Bull. Amer. Geogr. Soc.*, Vol. 44, 1912, p. 240.) Eight authors have aided him with results that are very uneven: Africa south of the Sahara is *Nigritia*. *Europe* is one division as far east as 25° from Greenwich—in mid-Russia. Here *Greater Siberia* begins, to extend to the Pacific. *Mongolia* is a division by itself. *East Asia* includes Manchuria, Korea, Japan, and eastern China. *India* takes in Indo-China and the East Indies. *Greater Australia* means New Guinea, New Zealand, and the rest of the islands with the continent Australia. *Arctis* and *Antarctis* explain themselves. *Central America* includes the West Indies. North of this the mountainous West is *Cordilleria* and south of it *Andina*. From the Rockies eastward to the ocean is *America*, and east of Andina is *East South America*.

This is a most interesting attempt. Greater Australia, Greater Siberia, and Nigritia are acceptable at sight. India and Central America open up more discussion with their inclusion of the East and West Indian islands, for insularity has marked geographic consequences. East Asia has an enormous range of geographic contrasts as compared with the monotonous Orient. In other words, the Orient is a relatively simple group of earth features. To match it throughout the world would give a very large number of natural divisions, many more than Banse's fifteen. This is strikingly true of "Europe," a natural division of great complexity, of which the Mediterranean border is closely allied to the African coast, which is so large a part of Banse's Orient. On many grounds "Europe" might well include North Africa down to the Sahara, for the Sahara is a true boundary, while the Mediterranean has always put its border peoples into communication, instead of separating them. Ethnically and culturally the boundary lies in the Sahara. Nigritia is an excellent unit from this viewpoint.

The American divisions, by Alwin Oppel and Willi Ule, are not prepossessing. Mexico and Alaska are as poor bedfellows in Cordilleria, as Venezuela and Chile in Andina. There is nothing about East South America to suggest a natural division, and the name is cumbersome. Only political considerations, which the Canadians would appreciate little, could recommend America as a name for the basins of the Mackenzie, the Mississippi, and the St. Lawrence, together with the Atlantic coast border. Its further subdivision into *Hudsonia* east and west of Hudson Bay, *Appalachia* in the mountains and eastward, and *Missouria*, to include the St. Lawrence and Mississippi basins, is even less attractive. The customary separation of America into two-world divisions at the Isthmus may be open to question; the reviewer finds better grounds for division at the Rio Grande into Latin and English America. It is worth while to note in passing that common use has come to accept the continent names as including more than the actual continent, in the sense of the land mass that holds together. English people may talk of going "to the Continent" when they visit France or Germany, but they and we know they are Europeans themselves and the British Isles a part of Europe. So Japan is a part of Asia, like Ceylon, Sumatra, and Java.

The present attempt deserves attention. One cannot try to assign boundaries to geographic divisions without focusing attention on the *criteria*. What would make a geographic division natural? MARK JEFFERSON.

—— **Annuaire Météorologique, 1913, II: Les Iles Féroé, l'Islande, le Groënland et les Antilles.** 88 pp. Dansk Meteorol. Inst., Copenhagen, 1916.

CORNISH, VAUGHAN. **The strategic geography of the British Empire, considered in relation to the Central Powers.** *United Empire*, Vol. 7, N. S., 1916, No. 2, pp. 142-160. [Abstracted in the July *Review*, pp. 66-67.]

DUNNING, W. A. **The British Empire and the United States.** With introduction by Right Honourable Viscount Bryce and preface by N. M. Butler. xix and 381 pp.; index. Charles Scribner's Sons, New York, 1915. $2.00. 9 x 6.

HARDING, GEORGE. **Coaling-ports of the world.** Ills. *Harper's Mag.*, No. 793, Vol. 133, 1916, pp. 27-37. [An account of the picturesque aspects of Port Said, Singapore, Nagasaki, Gibraltar, and Colombo, the most celebrated of the one hundred and forty coaling ports of the world. In the age of sail a vessel could go from China to Liverpool without touching at a port of call. The present-day mail steamer must renew its coal supply frequently even if it must "buy an island" for the purpose. The tramp steamer, built chiefly for cargo, is a slave to the geographical distribution of coaling ports and must figure out its coal schedule as carefully as its cargo schedule. There is a last section on the coal ports of the Caribbean and the Pacific in relation to the interests of the United States.]

HAZARD, D. L. **Results of magnetic observations made by the United States Coast and Geodetic Survey at the time of the solar eclipse of August 21, 1914.**

Terrestr. Magnet. and Atmosph. Electr., Vol. 21, 1916, No. 1, pp. 9-14. [Values for the stations Vieques, Porto Rico, Cheltenham, Md., Tucson, Sitka, Honolulu.]

Jumelle, Henri. **L'avenir de nos colonies.** Ills. *La Nature*, No. 2226, 1916, May 27, pp. 337-345. [French colonies.]

Newbigin, M. I. **The interrelations of Europe and Asia as exemplified in the Near East.** Map. *Scottish Geogr. Mag.*, Vol. 32, 1916, No. 5, pp. 216-227.

Robertson, J. A. **Bibliography of early Spanish-Japanese relations, compiled from manuscripts and books in the Philippine Library, Manila.** iv and 170 pp.; ills. *Trans. Asiatic Soc. of Japan*, Vol. 43, 1915, Part 1. Tokyo. [Introduction abstracted in the June *Review*, pp. 461-462.]

Roncagli, G. **Francia e Italia in Oriente e in Africa.** *Boll. della Reale Soc. Geogr. Italiana*, Vol. 5, 1916, No. 7, pp. 606-612. Rome.

W—, W. C. **Latin-American exports: An opportunity.** Ills. *Bull. Pan American Union*, Vol. 43, 1916, No. 2, pp. 190-204.

EDUCATIONAL GEOGRAPHY

Andrews, A. W. **A text-book of geography.** xii and 655 pp.; maps, diagrs., index. Edward Arnold, London, 1913. $1.25. 7½ x 5½.

As one of the most ambitious attempts in recent times to cover the whole field of geography in a single, usable text, this work deserves special notice. It runs to about 230,000 words, as compared with 150,000, 170,000, and 210,000 in the three texts most prominent in England and America. The omission of all illustrations except 115 black-and-white maps renders possible a book of convenient size and weight.

The style is a marvel of condensation. The sentences are short and clearly constructed, but packed with phrases and clauses, each of which adds to the load of meaning. The reader may count on having to take in, on an average, one new idea with every line, or about forty to the page. His ability to do so will depend on his powers of apperception. The process is made more difficult by an excessive use of the parenthesis, not only to interpolate incidental ideas, but for matter logically related to the context. Citations to matter which follows later in the book are so frequent as to constitute a system of pro-ference, rather than of reference. If they are looked up, they are found to fill a gap, but the gain in avoiding repetition is overbalanced by the loss in time and patience of the reader. Condensation, parentheses, pro-ferences, and unsparing use of complex concepts, regardless of the immature or uninstructed mind, render the book rather hard reading at first even for the seasoned geographer. If these difficulties are forced down, more geography will be found to the page than in any other book known to the reviewer. The command and use of facts make it what the author disclaims an attempt to provide, a condensed encyclopedia of geographical information. But more than that, there are few instances where isolated facts are given without explanation or suggestion of correlation with other facts, and thus the encyclopedia is transformed into an organic system. The principal strands on which organization is effected are climate and communications.

Under general geography, climate is treated in a thorough and original manner and without restraint. By the use of the isotherms of 32°, 50°, and 68°, the face of the earth is divided into ten zones and regions in each hemisphere, hot at all seasons, hot summers and warm winters, hot summers and cool winters, hot summers and cold winters, warm at all seasons, warm summers and cool winters, warm summers and cold winters, cool at all seasons, cool summers and cold winters, and cold at all seasons—a set of distinctions sufficiently fine. Practical exercises are set, based on a table giving climatic conditions at from 50 to 150 selected stations for each continent. From these data the student is expected to compile his own maps. If he does it in the light of the parallel discussion of the text, he will have a good working knowledge of the climates of the world. This is made the key to the distribution of natural vegetation and cultivated crops in the best modern manner.

Each continent is illustrated by a set of maps showing sea-level isotherms, actual isotherms, isobars, and winds and rainfall, each for January and July, a relief map shaded between contours selected to bring out desired contrasts in each case, a map of river basins and of vegetation. The use of large-scale orographic maps is constantly insisted on. In descriptions of relief, there is little said about ranges and peaks, but the subject is developed according to passes, valleys, trade routes, and lines of communica-

ion, which lead to the location of towns and cities. The resulting picture is one of fine letail rather than of impressionistic breadth.

In 95 pages of general geography, land forms, maps and map reading (elaborately), limate and biogeography are discussed, including the distribution of man and important economic products. Regional geography, which occupies the bulk of the book, is treated n the main according to political divisions. In the preliminary description of each ontinent, natural regions and their importance are not overlooked, but the aim is to present a view of ethnic, economic and social, rather than of physiographic units. First place is given to the British Isles, which occupy 70 pages. The usual classification of ocks and geological formations is made geographical by indicating their influence upon elief, soils, vegetation, and industries. In such a country, where natural divisions are small, well defined and generally recognized, regional description is delightfully easy and satisfactory. The links of the geographical chain which runs through the Lancashire cotton industry are fully traced in less than half a page. Salisbury Plain and the Vale of Wardour furnish occasion for a little gem of compressed and polished geography, showing the intimate relationships of structure, landscape, chalk downs, valleys, coombs, soils, flints, glacial features, quarries, pastures, ploughland, woods, plant associations, bird life, sheep, wheat, village sites, Stonehenge, Old Sarum, Roman oads, Salisbury Cathedral, base line of Ordnance Survey, military camp, and modern ailways.

Europe occupies 170 pages; Asia, 105, and Africa, 73. Space forbids quotation, but empting samples may be found in the cow as the dominating influence in the life of Alpine peasants (p. 267), the description of the Pamirs (p. 341), and the story of the Congo quest (p. 404). That no more space is given to North America than to Africa and considerably less than to Australia and South America combined is evidence either that North American geography is very simple or that the British geographer lacks a sense of proportion. It is to be hoped that the absurdity of the time-honored precedent of placing America after New Zealand and the Pacific tail-ends of the world, so that Hawaii is presented before the United States, may, in the lapse of ages, become evident to European geographers. A similar sentiment is aroused by the 17 pages given to the 7,000,000 inhabitants of Canada preceding 20 pages given to the United States with its population of 100,000,000. The section on the United States is the least satisfactory n the book, partly on account of brevity and partly on account of flaws which one on the ground can easily pick. In two pages on the development of communications in North America nothing is said about events later than 1800, except the Canadian Pacific, Grand Trunk Pacific and Canadian Northern Railways. A full-page map of the Canadian Rockies, showing river trenches, passes, and railways, is admirable. Cape Ann, Mass., is canonized and Anglicized into St. Anne's Head. New York, the second city, first seaport, and imminent commercial and financial center of the world, is dismissed in a dozen ines of fine print. Chicago ("on L. Huron") is said to be "to the north of deep avines cut by the Ohio tributaries in the glacial moraine lands." (Ye shades of the Wabash, the Kankakee, and the Illinois!) The elevations of the Great Lake ports are given as being from 100 to 260 feet above the lake levels, and the river ports of the Missouri, from Great Falls and Bismarck down, are stated as a student of the map might think they ought to be rather than as they are. Iron is still mined in the Ozarks, but mining in the plateau states is only incidentally mentioned. Central California is placed in "a desert depression," the first Pacific railways "turned the southern end of the Sierra Nevada in 1866," and coal mining is made more important in Washington than lumbering. The Panama Canal, "owing to tidal differences of level between the Pacific and Atlantic, will contain locks," and is accounted for by reference to Spanish mule trails and the railroad of 1855.

Jupiter is said to have nodded sometimes, and infallibility is superhuman. The American teacher would shrink from the adventure of piloting even a robust class through Mr. Andrews' book, but if he did, the class would know enough geography, outside that of the United States, to last them a lifetime. C. R. Dryer.

Dicks, A. J. **Cambridge geographical text books: Intermediate.** xi and 362 pp.; maps, diagrs., ills., index. University Press, Cambridge, 1912. 8 x 5½.

Production of a general geography compressed into three hundred pages is a difficult task unless carried out in the light of some dominant guiding principle. Such a principle is not apparent in the above text, which, partaking of the nature of a gazetteer, is chiefly open to criticism on the selection and veracity of the facts presented. Material is fairly distributed regionally, but errors abound and there are some serious omissions. A cursory examination reveals the statement that "Spain holds none of the mainland" of Africa and former German Southwest Africa is entirely ignored. In the section on

South America we are told that "more than half the coffee (of Brazil) is exported from Rio Janeiro" (in 1910, to take a year data for which should have been available for the text, the entire export trade of Santos was nearly two and a half times that of Rio Janeiro and 99 per cent of it was coffee!); that in Bolivia the llama is "the only animal which can be used for mountain traffic" (no mention of the importance of transportation by mule). Other statements are misleading. La Paz (Bolivia) is the greatest market for cinchona from the *montaña,* but the description of it as located "in the center of the cinchona district" is ambiguous. The teacher of the literal-minded, fourteen-year-old pupil will anticipate trouble from such an unfortunate term as "'Indo'-European" applied to the Peruvian *mestizo.* Causal connections might have been further developed without introduction of more material. Thus the nitrates of Chile might have been placed in the Atacama Desert mentioned in the previous paragraph, instead of being simply listed with other mineral products.

Haaren, J. H. **First notions of geography.** For fourth-year classes. v and 154 pp.; ills. D. C. Heath & Co., New York, 1914. 45 cents. 8 x 6.

Intended for pupils beginning the fourth year of the elementary school. The aim is to give the child a knowledge of the fundamentals of geography. Such subjects are taken up as weather, direction, clouds, rivers, seasons, food, clothing, shelter. The pupil is prepared to read a map. A great deal of the text is written in story form, the story being of an imaginary school-teacher and her class. By means of this teacher and her school the author gives the real child his "first notions of geography."

Wilbur Greeley Burroughs.

Baber, Zonia. **Lost opportunities in teaching geography.** *Journ. of Geogr.,* Vol. 14, 1915-16, No. 8, pp. 295-298.

Barker, Mabel. **Education for a state of peacedom through regional study. (A conference on regional surveys, V.)** *Geogr. Teacher,* No. 43, Vol. 8, 1915, Part 3, pp. 169-172.

Bell, Valentine. **Regional survey in the elementary school. (A conference on regional surveys, III.)** *Geogr. Teacher,* No. 43, Vol. 8, 1915, Part 3, pp. 164-166.

Branford, V. V. **The regional survey as a method of social study. (A conference on regional surveys, II.)** *Geogr. Teacher,* No. 42, Vol. 8, 1915, Part 2, pp. 97-102.

Brown, R. M. **Home-made maps and atlases.** *Journ. of Geogr.,* Vol. 15, 1915-16, No. 3, pp. 77-79.

Cornman, O. P., and Oscar Gerson. **Geography by grades, New York State edition: Third and fourth years.** 223 pp.; maps, diagrs., ills. Hinds, Noble & Eldredge, Philadelphia and New York, 1911. 8 x 6.

—— **Current material for the geography teacher.** *Journ. of Geogr.,* Vol. 15, 1916-17, No. 3, pp. 98-101. [Quotations from various current sources.]

Cushing, S. W. **High-school commercial geography.** *Journ. of Geogr.,* Vol. 15, 1916-17, No. 3, pp. 87-91.

Fleure, H. J. **Regional surveys in relation to geography. (A conference on regional surveys, I.)** *Geogr. Teacher,* No. 42, Vol. 8, 1915, Part 2, pp. 89-96.

Garlick, S. A. **The filing and presentation of illustrated geographical material.** Diagrs. *Journ. of Geogr.,* Vol. 15, 1916, No. 3, pp. 95-97.

—— **Geography: A report on a preliminary attempt to measure some educational results.** 38 pp.; diagrs. *Dept. of Educ. Investigation and Measurement Bull. No. 5 (School Document No. 14-1915).* Boston, 1916.

Goode, J. P. **Geography.** *Commercial Educ. Bull. No. 25,* pp. 52-53. Bur. of Education, Washington, D. C., 1916. [Author's abstract of a paper read at the Commercial Education Subsection of the Second Pan American Scientific Congress held in Washington, December, 1915–January, 1916.]

Grose, H. D. **How library work, field work, and laboratory work may be made mutually supplemental in the teaching of earth science.** *Journ. of Geogr.,* Vol. 14, 1915-16, No. 7, pp. 253-256.

THE
GEOGRAPHICAL REVIEW

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A PROPOSED AËRIAL EXPEDITION FOR THE EXPLORATION OF THE UNKNOWN INTERIOR OF NEW GUINEA

By ERIC MJÖBERG, D.Sc.
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Leader of the Swedish Scientific Expeditions to Australia, 1910-11 and 1912-13

Among the very few tropical regions of the earth that still retain to any considerable extent their "white spaces" New Guinea is the most noteworthy. Within the tropics there is no other area that has been, for so long a time, the object of systematic and strenuous exploration. Nowhere else has the onward-pressing explorer encountered such stubborn resistance as when he has tried to remove the mystic veil that still shrouds the interior and endows it with the charm peculiar to the unknown. Since the time when, in the dim, far-away days of the sixteenth century, the island was once sighted by Jorge de Meneses, a Portuguese driven out of his course by hard weather, nearly a thousand different explorers, single-handed or as leaders of strong and well-equipped expeditions—which at times have been of an international character and composition—and actuated by various motives, have set about the exploration of this great island. Nevertheless the fact remains that New Guinea, with its still unknown interior, is, within the tropics, the largest "white space" on earth.

Hardly a year passes without discoveries of the most sensational kind being made in this part of the world. Only a year or two ago, in the Dutch part of the island, there was discovered a large new oviparous mammal, an ant-eating porcupine, about a yard in length. In 1910 the expedition sent out to the Dutch part of the island by the British Ornithologists' Union, under the leadership of Mr. Walter Goodfellow, put on record the existence of a new race of men, the so-called Tapiro dwarfs, living on the heights of the Nassau Plateau. And it was only a few years ago that the well-known Dutch explorer, Dr. Lorentz, after two previous but unsuccessful expeditions, succeeded in reaching the long-desired goal, Wilhelmina Peak in the

central range, 15,585 feet high. He is the first white man to have set foot upon New Guinean snow.

As early as 1910, during my first expedition to Australia,[1] New Guinea already loomed before my fancy as the future object of my exploratory work. This idea grew upon me more and more, especially after I met in 1912 and 1913, at Brisbane, Sir William McGregor, the Governor of Queensland.

Among living explorers Sir William McGregor is, without doubt, the one who possesses the most intimate knowledge of New Guinea. In the long period from the early eighties to 1900 he made a series of journeys within the British part of the island for the purpose of studying it. Later, in his capacity of Lieutenant-Governor, he did much traveling, for practical purposes and on duty, but always with an eye open to the possibility of fresh discoveries. In 1906 and 1908 he climbed the highest summits of the littoral Owen Stanley Range, 13,000 feet in altitude, and also succeeded in traversing the southeastern peninsula.

Sir William McGregor strongly advised me to devote my exploring work in the future to New Guinea, where to this day so much that is still unknown remains to be revealed. I have accordingly been revolving this suggestion in my mind more and more and herewith present a plan of exploration which promises useful results.

Geographical Features of New Guinea

International Partition.—New Guinea is, as we know, divided among three nations: Holland, Germany, and Great Britain. All territory west of longitude 141° E. belongs to Holland. The boundary between British and German territory follows a broken line, dividing the eastern half lengthwise. The final partition of the island took place in 1884, when the German portion, which up to that time had only been a protectorate, was proclaimed a crown colony. The British part of the island—also called Papua, or "the Territory"—was incorporated with the Commonwealth of Australia in 1901, and later, by a special act of November 16, 1905, the so-called "Papuan Act," the country was placed under a Lieutenant-Governor subordinate to the Governor-General of Australia.

Topography.—New Guinea is situated just south of the equator, between the parallels of 0°19′ and 10°43′ of south latitude, and extends in an east-southeasterly direction from 131° to 151° east longitude. With its area of 300,000 square miles, it is larger than the Scandinavian peninsula and is, next to Greenland, the biggest island in the world. In the east, as in the west, it forms peninsulas. Eastwards, New Guinea is continued by several large groups of islands, Neu Pommern and the Louisiade Islands,

[1] Cf. the writer's account: Svenska biologiska expeditionen till Australien, 1910-1911, *Ymer*, Vol. 32, 1912, pp. 397-434; and his "Bland vilda Djur och Folk i Australien" [Among Wild Animals and Peoples in Australia], Bonnier, Stockholm, 1915.—Edit. Note.

and farther east by the Solomon Islands. Taken together with the latter it may be considered the remains of a former connected land complex. It is separated from Australia by Torres Strait, 96 miles in width. The two large bays, Geelvink Bay in the northern part and the Gulf of Papua in the southern, naturally divide the island into a central main land and two peninsulas.

The northern coast of New Guinea is mostly steep and high; in other parts the shore is flat and fringed by low-lying, swampy mangrove forests,

FIG. 1—Sketch-map of New Guinea.

extending inland for many miles. There the country is very broken and rugged, and intersected by high ranges of hills with valleys and plateaus between. The northwestern peninsula is ridged by a chain of high mountains, the Arfak Range (9,500 ft.). Beyond the neck of the peninsula and continuing to the east are the Charles Louis Mountains and the Snowy Mountains, or, as they are called nowadays, the Nassau Range, culminating in the snow-clad summits of Mount Idenburg (15,270 ft.), Carstensz Peak (15,706 ft.), and, farther east, Wilhelmina Peak (15,585 ft.) and Mt. Juliana (14,665 ft.). To the east of these are the Victor Emanuel and Sir Arthur Gordon Ranges, both close to the Anglo-German border. Still farther east we find the Bismarck Range, which is often covered with snow, and, forming the southeastern peninsula, the mighty Owen Stanley Mountains, the highest peaks of which are Mt. Albert Edward (13,100 ft.) and Mt. Victoria (13,150 ft.). Thus it will be seen that, from west to east,

a more or less connected system of mountains intersects the interior of the island, like an immense backbone.

As to the interior of the island, it is as yet practically unknown, but from the highest peaks that have so far been climbed the presence of still loftier mountains, with peaks mantled in dazzling white snow, and, intervening, less elevated expanses of ground have been revealed.

From a geological point of view, the island is very imperfectly known. However, we have reason to believe that the lowland south of the central ranges is in age and structure related to the older lands of Australia, while the ranges themselves are of more recent age and are akin to the partly submerged mountain arcs characteristic of eastern Asia. The relatively recent volcanic activity of the northern coast and the Bismarck Archipelago seems to attest this.

Climate.—As New Guinea is situated very nearly on the equator, its climate is hot and damp. At least, such is the case in the coast regions, so far the only parts fairly well known. But since from the heights of the coastal ranges lofty mountains may be seen, the summits of which are capped with snow, glaring white in the tropical sun, it follows that in the highlands of the interior a temperate climate must prevail. The mean temperature for the year is given as 79° F. On the north coast the warmest month of the year is March, with a mean temperature of 79°; on the south coast December is the warmest month, with a mean temperature of 82°. The coldest month is August, with a mean temperature of about 77°.

During the months of May to November—in the southern tropics the winter period—the southeast trades blow with unvarying strength, bringing a copious rainfall in parts. During the rest of the year, which constitutes the summer, the northwest monsoon sets in, frequently deluging the northwestern and western parts of the island with tropical cloudbursts and violent and persistent torrential downpours.

In the southeastern parts a dry season prevails during the winter, but such is not the case on the north coast, where rains fall every day in the year, often accompanied by violent electric discharges. This coast accordingly shows the heaviest rainfall, namely 79 to 118 inches, varying according to locality. Higher up in the mountains considerably more rain falls, and it is definitely stated that, in places, as much as 382 inches has fallen in a year. In especially wet years the rainfall in the low-lying parts has varied from 197 to 236 inches.

As a natural consequence of the enormous rainfall, mighty watercourses traverse the country on their way down to the sea. The largest river in the island is the Fly River, in British territory. Its sources are not yet known, but they are probably to be found in the mountains on the Anglo-German border. This river drains an area of enormous extent. The length of its course from the sea to the Anglo-German border is estimated at 620 miles. It is navigable, at least for motor boats, for about

500 miles. It is under the influence of the tides as far as 200 miles from its mouth. All along its course the banks are covered with dark and dense primeval forest. The volume of its waters is very large. Other great rivers are the Markham, discharging into Huon Gulf; the Ramu, with its sources in the Bismarck Mountains; the Kaiserin Augusta, or Sepik, River, which drains large regions of the north, and, with its tributaries, extends up to the Victor Emanuel Mountains; and the Mamberamo, which, with its affluent, the Idenburg River, drains the northern slopes of the central range in Dutch New Guinea.

As far as we know, no stagnant bodies of water are to be found, but it is nevertheless highly probable that there are some lakes in the level parts of the interior. In the following pages I shall return to this question in connection with another matter.

Vegetation.—Bearing in mind the equatorial position of New Guinea and its humid climate, it is to be expected that its vegetation would be of a very luxuriant character. A dense and uncompromisingly tangled primeval forest covers the greater part of the coast land, as well as the rising ground towards the mountains for a considerable distance. This "bush" bears a striking resemblance to the jungles of Queensland, although a stronger admixture of Indo-Malayan elements is noticeable. The coasts are edged with a belt of swampy mangrove forest, several miles in width, which at low water exposes a tangled network of main and auxiliary roots covered with slimy mud. Wherever one may look the eye is met by dark and dense primeval forest, with here and there a patch of lighter color. Such patches are grass-grown and are known by the name of *alang* steppes; they will be referred to again later.

At an altitude of about 10,000 feet the bush begins to show signs of becoming more sparse. The trees are hung with moss, all damp and dripping, and new elements begin to intrude themselves. Another ascent of 1,500 feet and the tree limit has been reached. Primeval forest gives way to an inferior kind of brushwood vegetation, with a dense undergrowth. Another thousand feet upwards, and an alpine vegetation appears, with fine greenswards and flattened plants of a northern alpine type.

Animal Life.—Leaving the vegetable kingdom for a cursory glance at the fauna of the island, we find that animal life in New Guinea is quite individual, even if obvious points of contact exist, on the one hand with the Malay Archipelago, and on the other with Australia. Of the mammals a good many are arboreal, but kangaroo types are also found in the parts where the country is more or less open. Two species of ant-eating porcupines are indigenous to the island; one of them attains a considerable size and, as has already been mentioned, was only discovered a year or two ago in the Dutch part of the island. Other mammals found here in a wild state are rats, bats, and a species of pig.

As is well known, New Guinea is pre-eminently the land of birds of

paradise. In the silent depths of the primeval forest they display a wealth of color and a variety of shape which is without parallel in the animal kingdom. Wallace emphasized the greater splendor of this bird fauna as compared with that of Brazil. More than sixty species are indigenous to the island. Only one species has spread to Australia.

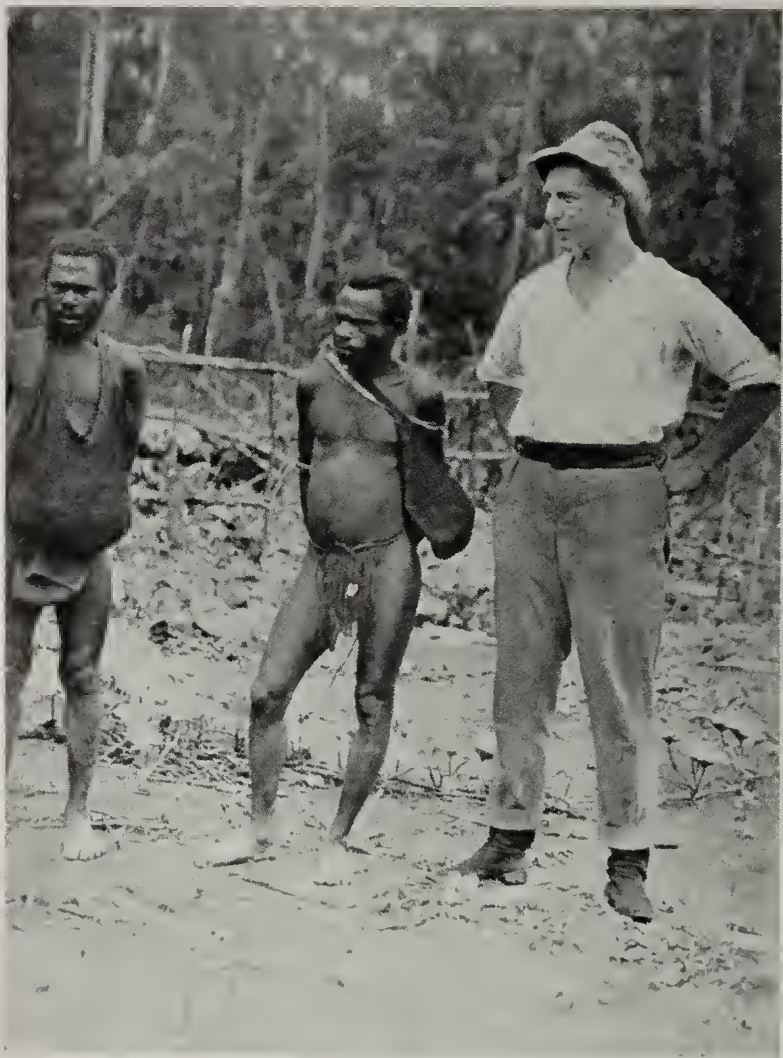

FIG. 2—Tapiro pygmies of New Guinea compared in stature with a white man. (From Capt. C. G. Rawling's "The Land of the New Guinea Pygmies," London, 1913.)

The rest of the indigenous bird life is also wondrously developed. In New Guinea parrots are found of the most varied colors and shapes. The smallest is of the size of a tomtit. Another comparatively ancient group are the pigeons, of which no less than thirty-nine distinct species live on the island. Six of the local bird families are, as to their habitat, restricted to the Australian-Papuan region, viz. the cockatoos, birds of paradise, cassowaries, Megapodes, Meliphagides, and the Podargides.

Population. — As is well known, New Guinea is the country of the Papuans. Terminology and grounds of classification have long been in a state of confusion and incommensurability. But it has become more and more customary to class as Papuans only the natives of New Guinea proper and of several adjacent islands. The natives of the Bismarck Archipelago and the Solomon Islands belong to the Melanesians, of which race also were the now extinct aborigines of Tasmania. The aborigines of Australia, on the other hand, form a distinct and typical group of their own.

As regards the Papuans, there has in the course of time taken place a considerable intermingling with other races. In the western parts there has been an infiltration of Malayan and Mongolian elements; in the northeast, of Melanesian, and in other parts, of Semitic strains. There has also

been blending with the dwarf peoples. All this has resulted in making the anthropological questions particularly complex.

In mental development the Papuan is far superior to his neighbor to the south. Unlike him, he has attained the status of an agriculturist. He has learned to take thought for the morrow. He has emerged from the nomad stage and has become a dweller in fixed abodes. His huts are grouped together in village communities, and the first steps toward social specialization are undeniably evident. With tools of a primitive kind he cultivates the land about his huts. His domestic animals are the dog and the pig.

Fig. 3—Group of Tapiro pygmies of New Guinea, with two coast Papuans in the background. (From Capt. C. G. Rawling's "The Land of the New Guinea Pygmies," London, 1913.)

The Papuan is an artist of no mean ability. What a difference between the rude and primitive utensils of the Australian aborigine and those of the Papuan, which are tastefully ornamented or artistically plaited; or the beautifully and richly carved canoes, spears, bows, drums, masks of many kinds, mummies, etc., not to mention the so-called "spirit houses," wherein are deposited all sacred and ritual objects.

The hut of the Papuan is originally of a circular type, but the most varied modifications are to be seen. The hut is always built on pillars. In this way it is raised above the damp ground, and at the same time is rendered safer from enemies. The space underneath is utilized as a stable for the domestic animals, as a store-house or depository, or for similar purposes. The roof of the hut rests on one central pillar, or it may be supported by several. Roof and walls are built of poles, together with thick layers of wood-fiber and bark, interwoven with withes of the rattan palm, plaited around and between the building materials.

The floor of the hut may even be placed on pillars of such a height that the owner is obliged to make use of a small ladder in order to reach it. We find that this idea of elevated dwelling-places has been carried to its furthest development in actual arboreal habitations. High up in the top of a big tree quite a little village may be located, well protected against the attack of an enemy.

Along the coast, and in swampy regions the natives live in pile dwellings. Here they lead the primitive life of the fisherman.

Social relations between individuals, sexes, and tribes are of a varied character. As a rule, the natives occupy separate houses according to age

FIG. 4—"Spirit," or ceremonial, house, Sissanu, western part of northern coast of German New Guinea. (Figs. 4-7 and 9-12 are from R. Neuhauss' "Deutsch Neu-Guinea," 3 vols., Berlin, 1911.)

and sex: the married women in one hut, the unmarried in another; the young men in one, and the married men in another; the elders in another, and so on.

Woman's social position is a somewhat lowly and oppressed one. Polygamy is allowed, but in practice is only indulged in by those who are well off, such as the chiefs, the witch doctors, etc. The wife is acquired by purchase, and is bought by the tribe. To her alone is acknowledged the ownership of her child, which the husband imagines to be once for all ready-made in her body.

A particularly interesting phenomenon to be observed in New Guinea is the sporadic appearance of dwarfs. They may generally be looked upon as instances of atavism. Up to about 1910 only solitary individuals, here and there, were known, but the subsequent discovery of the Tapiro dwarfs and the Goliath dwarfs—living in the mountains of that name in the Dutch territory—has established the existence of pygmy tribes.

We find that pygmy races appear in more than one part of the world. Even the ancient Egyptians told of pygmy peoples of the central and southern parts of Africa. Pygmies have long been known to exist in the Indo-Malayan regions, likewise in certain parts of Oceania.

From the existence in widely separated parts of New Guinea of cases of typical atavism, the conclusion was very properly drawn that, in the past, pygmy races were much more widely distributed than is the case in our own times. This was fully confirmed by the discovery of the above-mentioned two pygmy races. It is obvious that the pygmies would have to fall back when crowded by a race which was by far their superior in stature and bodily strength. And that such must have come to pass is shown by their occupation of the remote slopes of the Nassau Mountains, where no Papuans have settled, and by their not being met with, in any compact groups, in the coastal regions occupied by the Papuans.

The Tapiro dwarfs are distinctly a nation of hunters. They roam the mountains, armed with their bows and arrows. However, our knowledge of these people is, unfortunately, only very fragmentary. They live in a small village situated several hundred feet above the Tapiro mountain. When first seen by white men, they were exceedingly timid, and hid away all their women and children in the hills above their village. By degrees they became more accessible. They seem to maintain peaceful relations with their nearest Papuan neighbors. They walk about quite naked except for a girdle from which a fringe hangs down. They carry bags made of fiber, in which they keep all their movable property. They still use stone hatchets. They live in square huts, built on poles, with walls made of split tree-stems. Here and there they have tilled the soil and carry on the cultivation of bananas, taro, and other edible vegetables acquired by barter from the Papuans.

As to how the interior of the island is peopled, or if it is peopled at all, we know nothing. It has, however, been conjectured, and on very good grounds, that the numerous plateaus and valleys of the central parts of the island may prove to be inhabited by people of pygmy race, of whom we know nothing as yet. Mayhap descendants of the aboriginal inhabitants of the giant isle still live here. A rich and highly interesting field probably here awaits the fortunate pioneer explorer.

A matter of the very greatest interest is the fact that in New Guinea have been found indisputable traces of a prehistoric population. The fact is that in various parts of the island ethnographical objects of great age have been discovered, which are quite unfamiliar to the present inhabitants of the country. Their existence was first brought to light by Professor Neuhauss,[2] than whom no one is better acquainted with the German part of the island.

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[2] R. Neuhauss: Deutsch Neu-Guinea, 3 vols., Reimer, Berlin, 1911 (reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 220-221).

The most interesting of these are perhaps the stone troughs, or mortars, with their pestles, which have been found in the region round Huon Gulf. They are of considerable size, and were evidently used for pounding hard substances or objects. What these objects may have been is not known. The natives of our own day have no use for stone mortars of this description, as they are not in the habit of pounding, or crushing, the harder kinds of seeds, fruits, or other requisites.


Fig. 5—"Spirit," or ceremonial, house, Malol, western part of northern coast of German New Guinea.

Among other things from archaic times there are some smallish images of stone, ornately sculptured, which, according to Neuhauss, show an artistic taste and skill of such high quality that it may be taken to be quite out of the question that the Papuans of our own time could have been able to produce anything like them.

It is also probable that the stone hatchets still in use by the natives—although in our own days becoming more and more scarce—have belonged to an earlier, more primitive people. We do not know the locality where a single one of these tools has been manufactured, although the natives themselves tell us that they are made here, there, and everywhere—but without being able to point out any definite spot. Their archaic patination and otherwise old-time appearance indicate that they date from a past era.

The fact is thus established that New Guinea, also from an ethnological point of view, offers a multitude of unsolved problems. As yet we do not know anything of the mountain peoples who, in all probability, are to be found in the interior. There, perhaps, will be found the key to many of the anthropological riddles—as difficult of solution as they are interesting—that present themselves in the great island.

Outline of Proposed Expedition

Since, then, the compact belt of dense, swampy, and malaria-infested,

primeval forest encompassing the highlands of the interior to this very day remains an impenetrable barrier, I have for many years past been thinking over a plan for reaching the interior by way of the air. Thus there would be eliminated at one stroke all the hardships and privations, well-nigh beyond human endurance, which are inseparably attached to the forcing of a passage through the coast belt.

FIG. 6—Tree-house in German New Guinea.

It is well known what extraordinary progress has been made in modern aviation, particularly during the past two years. There is hardly any exaggeration in saying that man has conquered the air. One need no longer doubt the strength, carrying-power, reliability, and navigability of modern aëroplanes. At the western war front it happened only lately that two aviators, at an altitude of 13,000 feet, engaged in a sharp fight, which resulted in one of the combatants, damaged by his opponent's gunfire, falling headlong to destruction. Even in 1910 such an occurrence would have been deemed a sheer impossibility.

By the adoption of powerful, fixed engines, two or more in number, missing of the motor—formerly of common occurrence, and the cause of many a disaster—has become more and more rare. In this eventuality the sole means of safety has, so far, consisted in descent by volplaning, and then only provided a suitable landing place was within reach.

My idea is to find, by means of aëroplanes, practicable landing places in the interior of the island whence communication could be established with one or more depot camps at the coast.

The solution of this problem I have in the main conceived as follows:

One machine should be built especially adapted to carry heavy freight. This should be a powerful, multicylinder biplane of a special type, to seat

five passengers and to carry ballast of a minimum weight of 1,000 pounds. The building of a machine to meet these requirements would not in any way be difficult. The other machines should be biplanes of much lighter construction, seating only a pilot and an observer. The primary and most important business of these machines would be to search out and report upon possible landing places in the interior.

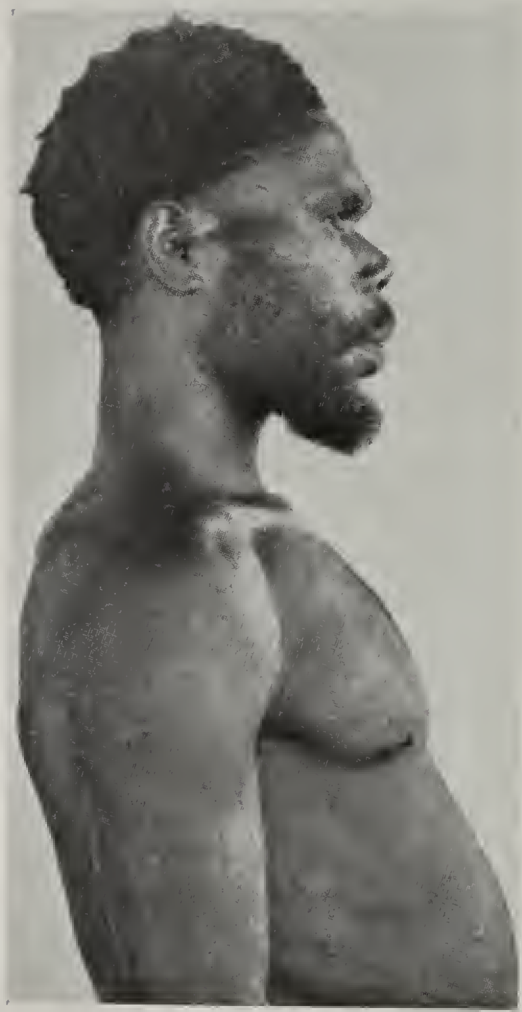

FIG. 7—A native (Papuan) of Bukaua, northern shore of Huon Gulf, German New Guinea.

Having located and fixed upon a suitable alighting place, the lighter machines would return to the depot camp at the coast. Thereupon, when meteorological conditions are as favorable as possible, the larger, freight-carrying machine would proceed to the selected landing place and discharge passengers, a first instalment of equipment, and provisions. This done, it returns to the depot in order to go back again to the inland camp without passengers, but with a full load of supplies. Regular trips between the two camps would subsequently be made as required, moving provisions and equipment from the coast to the inland camp, and returning with collections from the interior, to be immediately taken in hand and packed by the staff at the coast. Here would be stationed the lighter machines and their pilots, in constant readiness for duty.

The inland camp could be maintained until the surrounding country was carefully and systematically explored and mapped. With this done the camp could easily be moved to some other suitable site, and from this new center fresh exploration and research could be carried on. Once a satisfactory base has been established in the interior great possibilities are thrown open for exhaustive research work for a number of years to come.

Such matters as suitable machines, petrol, hangars, etc., are, as I shall show in what follows, easily disposed of, and of quite secondary importance to another matter which is momentous and decisive, that is, whether it is possible to land at all in the interior.

As early as three years ago, when I first met Sir William McGregor in Brisbane, I discussed with him, at length and in detail, my plan for an expedition into the interior of New Guinea by way of the air. He took

up this novel idea with great interest and considered the project well within the limits of possibility. To my question as regards landing prospects he told me that for his part he considered there existed especial facilities, to judge from the character of the country in the highest parts of the Owen Stanley Range, which he had been the first to visit.

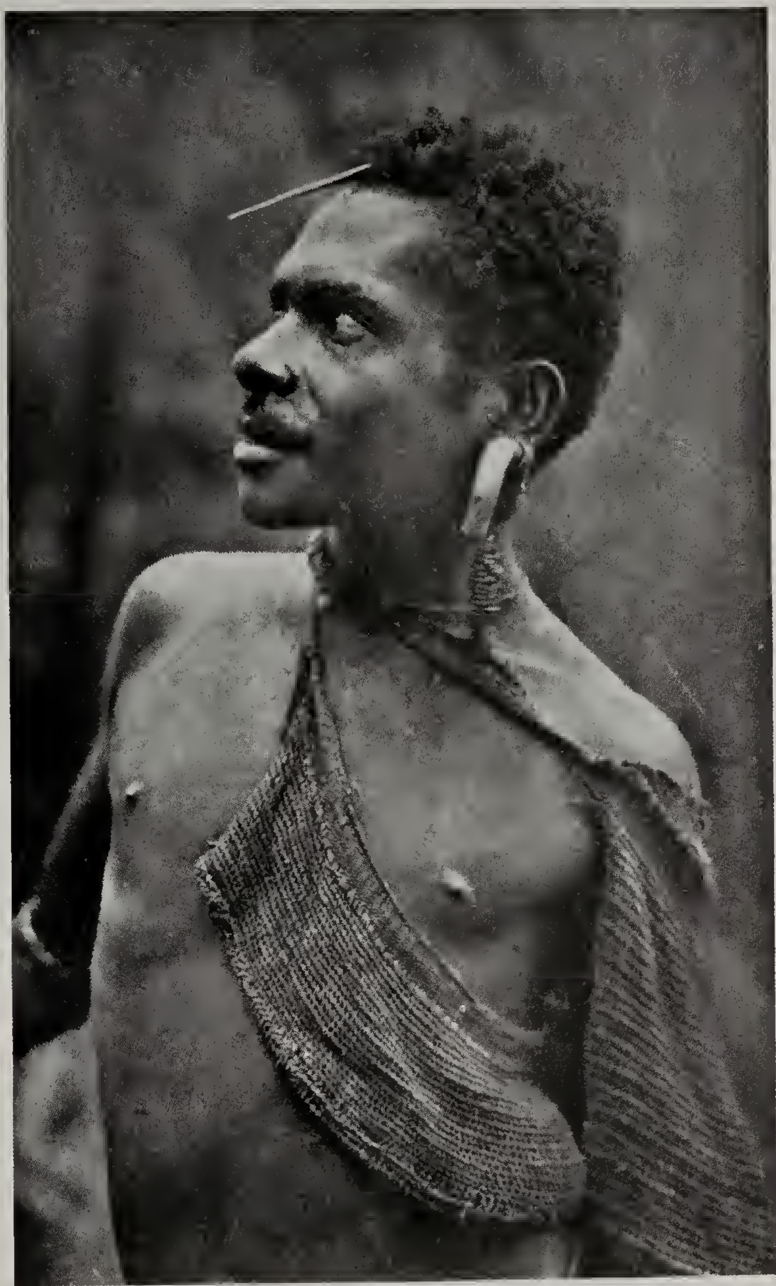

FIG. 8—A Tapiro pygmy of New Guinea. (From A. F. R. Wollaston's "Pygmies and Papuans: The Stone Age To-Day in Dutch New Guinea," London, 1912.)

Thanks to Sir William's researches we now know that the tree limit—i. e. the line above which the primeval forest does not extend—on the coastal mountain ranges begins at an altitude of about 11,500 feet. Above this height vegetation becomes more and more sparse, with dwarfed trees and low-growing brushwood, gradually changing into alpine meadows of soft grass, and prostrate herbs. When Sir William approached altitudes of 13,000 feet he met with a very quaint vegetation, in many respects reminiscent of the Alps and of northern Europe. Here, practically on the equator, he regaled himself with strawberries picked off the grassy lawns. He saw here several old acquaintances of his childhood: lady's mantles, with crystal dewdrops sparkling in the tropic sun, alp roses of the well-known rhododendron family in a variety of species, *Pedicularis, Lactuca, Leontodon, Myosotis, Ranunculus, Hypericum, Epilobium, Galium, Gentiana, Senecio, Veronica, Potentilla,* and other familiar northern forms.

In the interior, where highland plateaus with peaks covered with dazzling white snow predominate, the climate is bound to be considerably

more temperate. From this it may be inferred that the tree limit will be found at a correspondingly lower altitude. In any case, the alpine meadows of the interior are sure to be far more widely distributed, and herein we see *the first of the landing possibilities on which we are reckoning.*

It is extremely probable that there is no connected forest belt in the interior. Indeed, it may be strongly doubted whether the primeval forest, composed as it is of Indo-Malayan elements, has been able to extend beyond and above the coastal ranges that shut off the interior of the island. It is, on the contrary, most probable that there will be found open savannas,

FIG. 9—Women potters, Laukanu, German New Guinea.

After the pebbles have been kneaded out of the clay, it is shaped into rolls 8 to 12 inches long (note the woman on the left; a number of rolls may be seen on the right edge of the photograph). These are bent into rings and placed one above the other to make the first rough form of the vessel.

sparsely dotted with gum trees, i. e. bush of North Australian character, and with the ground covered with soft grass. Moreover, such patches of eucalyptus bush are known to exist in the coast forests of New Guinea, where they appear, here and there, hemmed around by the dense and gloomy jungle.

There is reason to believe that the primeval forest in its compact form has not become predominant in the interior. The high coastal ranges and a more temperate climate must here have constituted a hindrance to its progress. On the rises and in the valleys there will probably be found open plains or thinly wooded forests, and thus we may count upon *a second possibility of landing.*

From our actual experience of the island—though, so far, very slight—we already know of the existence, here and there, of open, light-colored fields, some of them measuring many miles across. At first they were thought to be grass-grown, sun-bathed meadows, but this illusion was soon dispelled when the real nature of these lighter patches became known.

Fond hopes had been entertained that these tracts might some time be thrown open to cattle-rearing and agriculture. It was found, however, that the presence of these open fields was a sure sign of a barren and sterile soil, as they were only covered with a stiff and harsh kind of grass, the so-called *alang* grass (*Imperata arundinacea*), which in the dry season stands parched and yellow. On these plains a landing would not be practicable off-hand, but by dropping fire-bombs from the smaller, scouting aëroplane the grass could easily be burnt off, and in that way suitable landing places would be ready in a few days. Thus we have here *a third, and very excellent, possibility of landing.*

FIG. 10—Stone mortars, relics of prehistoric inhabitants of New Guinea.

By the foregoing I have shown that three different possibilities exist in the way of landing, viz. the open alpine meadows, covered with soft grass and low-growing herbs; the open or thinly wooded savannas that will probably be found in the interior; and, lastly, the *alang* steppes that are scattered here and there.

Personally, however, I am of opinion that a fourth possibility presents itself, and a most excellent one. In a country of so mountainous a character as New Guinea, with snow-clad peaks attaining a height of nearly 16,000 feet, and valleys in between, inland lakes are bound to exist. That such may be found even in the densest jungle was taught us by our experience in the primeval forests of Queensland, of which I have personally a thorough knowledge. In those jungles, quite unexpectedly, one comes upon splendid and gleaming sheets of water, mirroring the dark mass of the primeval bush by which they are walled in on all sides. They are of volcanic origin, or so-called crater lakes. Now that we know how intense

volcanic activity has been, and still is, in New Guinea, it would surely be very strange indeed if such lakes did not exist in an area that is larger than the Scandinavian peninsula. It is also most probable that lakes of non-volcanic origin are to be found in the interior.

Here, then, lies before us *a fourth possibility of landing, i. e. by alighting with a hydroplane on some inland lake.* Hydroplane floats should accordingly be included in the equipment. They could easily and quickly be fitted to the larger biplane, which, though originally designed for alighting on land, would thereby immediately be converted into a hydroplane; also for the lighter machine, floats should be taken for an emergency. To find and locate what inland lakes might exist, as well as landing possibilities in general, would be the lighter machine's principal and most important task.

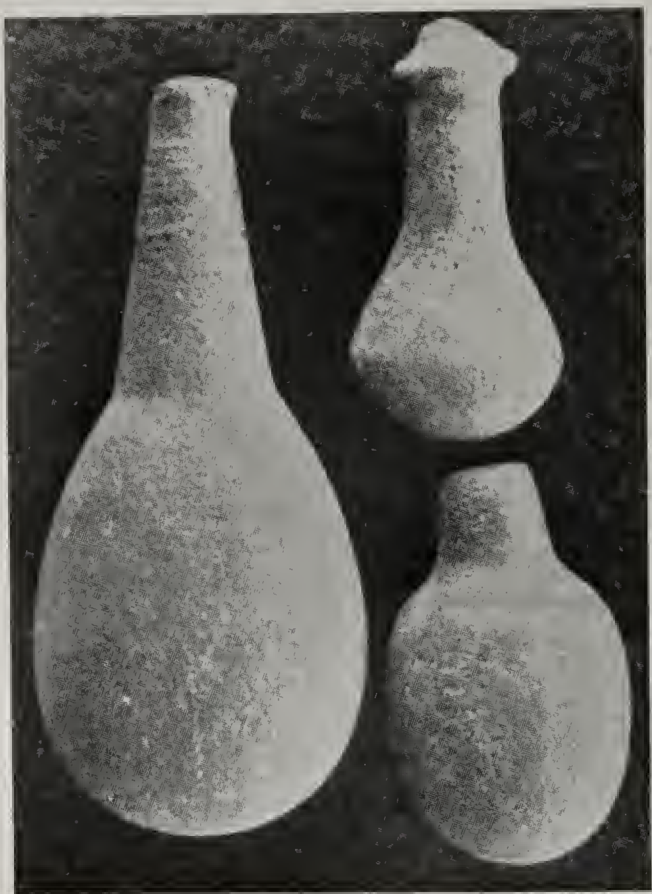

Fig. 11—Prehistoric pestles, made of lava, from Bukaua, German New Guinea.

Wireless telegraph apparatus should also figure on the list of equipment. It could be erected at a reasonable cost. The importance of a wireless station is obvious, as thereby daily communication could be maintained between the inland camp and the depot at the coast.

The equipment should also include instruments for scientific observations, such as fixing positions, mapping, meteorological research, etc.

The composition of the proposed expedition and the duties of its members should, it seems to me, be as follows:

My own work would be generally to supervise the journey and progress of the expedition, and in particular to lead its scientific work, at least to begin with, until it had been ascertained whether it is possible to establish a base camp in the interior. This done, we could at once see about adding one or more specialists to the staff; first of all, a botanist and a geologist.

Four expert and experienced airmen should be of the party, as well as three well-qualified mechanics. They would constitute the flying staff of the expedition, but would naturally be very useful in other kinds of work when not actually engaged in their professional pursuits.

Two experienced topographers, either army staff officers or other persons

proficient in surveying, should be of the party. To them would be entrusted the task of mapping the territory covered, not only by the methods that are generally employed, but also from the air by means of phototopography, and with a cinematograph. These more modern methods have, of late years, been used with great success. It is easily seen what an excellent opportunity here presents itself—whilst sailing over the expanses in an aëroplane—of taking bird's-eye views that afterwards could easily be made into maps.

Because it is proposed to make as full a collection as possible of zoölogical and botanical specimens, an expert taxidermist would be needed. He might also assist in other work. It is probable that the fauna, as well as the flora, of the interior highlands is quite distinct from that of the coast country, hence the importance of obtaining the fullest possible collections. In the high mountains of the coast there are, we know, a great many species of birds of paradise of very limited distribution, and therefore we have reason to expect that the fauna will be enriched, in particular, by new and interesting species of birds.

FIG. 12—Stone clubs in use by the present natives of New Guinea, but probably dating from an earlier people.

Should we succeed in establishing a fixed main camp in the interior, it follows that an increase in the staff would be necessary. A professional botanist, a geologist, and perhaps yet another scientist, might then be conveyed by aëroplane to the new field of research. Testing the machines for safety and navigability and preliminary practice in mapping and cinematographing the ground from an aëroplane would form essential elements in the preparations for this enterprise.

The problem of hangars for the machines is easily solved. A strong tent, pitched in a sheltered spot, is all that is required. At the depot on the coast a shed of corrugated iron could easily be put up.

As regards the carrying of petrol, the supply would naturally have to be directly proportionate to the distances that are to be flown. The subjoined plan shows the central portion of New Guinea with a square inscribed, the sides of which are 300 miles. This figure is intended to give a rough idea of what distances have to be reckoned with. The diagonal of this square is about 425 miles, or from each corner to the intersection about 215

miles. That this distance is well within the radius of action of an aëroplane is evident. With a speed of 60 to 90 miles an hour, it would only be a question of remaining in the air a few hours, above the forests and plateaus of the island. A petrol supply sufficient for a consecutive flight of ten hours can easily be carried.

FIG. 13—Outline of New Guinea showing distances to be covered in exploring the interior.

As vast areas of still unexplored country are to be found within far easier reach than that—as for instance beyond the Nassau Plateau, and several others of the high coastal ranges, in Dutch, as well as in German and British, territory—it is clear that magnificent prospects are here open to whomsoever will be the first to utilize the aërial method of exploration.

THE DEVELOPMENT OF THE APPRECIATION OF MOUNTAIN SCENERY IN MODERN TIMES*

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In the literature of the Middle Ages we are struck with the same lack of interest in mountains and mountain scenery which is so characteristic of Roman writers. No one seems to have crossed the mountains for any other reason than direst necessity; no poet spoke of them, and if the minnesingers of the twelfth and thirteenth centuries were impressed by the beauty of woodland and field and the songs of birds, they failed to draw inspiration from this side of nature. Even to Dante, the greatest of medieval bards, the mountains were inconceivable except as huge masses of broken stones and crags: their majesty entirely escaped him, and he viewed them as objects of terror only fit to guard the entrance to his innermost hell.[1] The general feeling of awe and disgust with which the Alps were early regarded is seen in a letter of Master John de Bremble, a monk of Christ Church, who in 1188 found himself at the top of the Great St. Bernard Pass; he speaks of "shuddering at the hell of valleys" below him and prays the Lord to restore him to his brethren that he may tell them never to approach "this place of torment."[2]

And yet the Alpine chains were familiar objects to great numbers of travelers bent on missions of religion and healing. At the bases of the great routes across them missionaries built monasteries and churches, and around them villages slowly grew; while in the passes above hospices were founded to receive the crowds of pilgrims from the north and west of Europe[3] who poured across the mountains on their way to Rome. Thus a hospice on the Great St. Bernard has existed since 859, while a monastery stood on the site as early as 812. The date of its refounding by Bernard of Menthon is generally given as 962 or 968, but must have been in the next century.[4] From the Italian side, too, invalids ventured north to seek health in the mineral waters of Switzerland and Germany, like Baden

* In a recent paper (The Ancient Appreciation of Mountain Scenery, *Classical Journ.*, Vol. 11, 1915-16, No. 2, pp. 70-84; abstracted in the July, 1916, *Review*, pp. 64-65) the writer discussed the subject of the Greco-Roman appreciation of mountain scenery. In the present essay the development of esthetic interest in this phase of nature through the Middle Ages and modern times will be traced very briefly.

[1] For Dante's repugnance see Ruskin: Modern Painters, Vol. 3, Ch. 15, §17; Freshfield, Notes on Old Tracts, IV: The Mountains of Dante, *Alpine Journ.*, Vol. 10, 1881, pp. 400-405; Brentari. *Boll. del Club Alpino Italiano*, 1887, No. 54, pp. 12-61.

[2] See Stubbs: Lectures on the Study of Medieval and Modern History, and Francis Gribble: The Early Mountaineers, 1899, p. 4. For a good example of medieval theories of phenomena encountered on mountains, see Sir John Mandeville's account of Mount Athos.

[3] Especially from England, Ireland, and Iceland.

[4] See discussion of Bernard's date by A. Lütolf in *Tübinger Theolog. Quartalschr.*, Vol. 61, 1879, pp. 179-207, who gives 1081 as the date of his death. The monastery, possibly then situated in Bourg St. Pierre, is first mentioned about 812: "monasterium quod est situm in monte Jovis"; see Gremand: Documents relatifs à l'histoire du Valais, Vol. 1, p. 21.

in Aargau. But despite all this, we hear of no mountain ascents for their own sake, nor praise of mountain grandeur, until the poet Petrarch, in 1336, following the classical example of Lucretius, climbed Mont Ventoux near Avignon in Provence. In a letter to a friend the poet says he had long cherished the ambition to ascend this mountain; he magnifies the difficulty of the undertaking—it is only 6,270 feet in height—but the view fills him with noble thoughts.[5] The following year he went to live at Vaucluse and devoted himself to a life of study and communion with nature in its wildest moods, climbing hills and traversing gorges, thus distinguishing himself from all other medieval scholars.

Though Petrarch was the first to break with the usual vague terror inspired by the mountains and the first to record sentiments of admiration, his ascent was preceded by two others. The earliest climb recorded in modern mountaineering history seems to have been that of the Roche Melone (Monte de Roccia Melone, 11,600 feet) near Susa in Savoy. The knight Bonifacio Rotario d'Asti is said to have founded a chapel on its top in 1358 and to have placed within it a bronze statue of the Virgin (now in the cathedral church of Susa); but there is a description of an earlier attempted ascent recorded by an anonymous chronicler of the monastery of Novalesa, written in the first half of the eleventh century and based on an account given to the chronicler by an old man who had tried to reach the summit.[6] The mountain, "arx Romulea," was supposed to have been the treasure home of a wicked King Romulus and to have been infested with wild beasts. In June, 1588, the Seigneur de Villamont visited the chapel with two guides, and his account is the earliest detailed one of any important Alpine climb.[7] The other ascent mentioned was that of the Pic Canigou in the Pyrenees by King Peter III of Aragon (1236–1285);[8] he found a lake at the top which was the home of a monstrous dragon. It will be seen from these accounts that the people of the Middle Ages not only had physical difficulties to overcome in climbing mountains, but those of a mental sort as well, for they believed that mountain regions were haunted by winged dragons, gnomes, goblins, and all kinds of evil spirits.

Between the date of Petrarch's ascent and the sixteenth century several mountain climbs are recorded. Thus towards the end of the fifteenth century the artist and scientist, Leonardo da Vinci, ascended Monboso, as is attested by fragmentary passages in his "Literary Works."[9] Monboso

[5] See his account of the ascent on June 26th in a Latin letter (De rebus familiaribus, Lib. IV, Ep. 1) translated by Henry Reeve in his "Life of Petrarch" (Blackwood's Foreign Classics for English Readers); the original letter is given by Gribble, *op. cit.*, App. D, pp. 264-270, and Reeve's translation, *ibid.*, pp. 18-24.

[6] See Gribble, *op. cit.*, App. A, pp. 257-258, for the chronicle and his translation on pp. 5-7.

[7] See Gribble, *op. cit.*, App. B, pp. 259-261, and translation, *ibid.*, pp. 7-10; the Englishman Thos. Coryate, in his "Crudities Hastily Gobbled Up," 1611, also described it in the early seventeenth century. Murray's "Guide to Switzerland" gives an account of the ascent of the Knight d'Asti.

[8] See chronicle of Fra Salimbene of Parma in Gribble, *op. cit.*, App. C, pp. 262-263, and translation, *ibid.*, pp. 15-17.

[9] Edited from original manuscripts by J. P. Richter, 1883; see especially note 1060; also part of a letter in Gribble, *op. cit.*, App. E, p. 271, translated by Mrs. R. C. Bell, *ibid.*, pp. 25-26.

has been identified by some with Mt. Monbego, 9,326 feet high, in the Maritime Alps; by others with Monte Rosa.[10] In June, 1492, Charles VIII of France, while passing through Dauphiné, was impressed with the rocky Mt. Aiguille near Grenoble (about 7,000 feet), and ordered his chamberlain De Baupré to ascend it; the latter deposited three crosses on the top, heard mass, and remained there about a week. This ascent is attested by a grave deposition of a special commissioner, now in the archives of Grenoble,[11] which is the first detailed account of an ascent still considered difficult. In the New World, it is believed that Diego de Ordaz was the first European to ascend the volcano Popocatepetl in Mexico (17,850 feet); the only proof, however, is a letter to the King of Spain written by Cortez, in which he says he sent a party of Spaniards in 1519 to the top of a "burning mountain" to get sulphur for making gunpowder. In 1522 Francisco Montaño lowered himself into the crater 450 feet—an undertaking now commonly performed by Indian sulphur miners by means of rope-ladders.[12]

It is not, however, until the sixteenth century that we first find indications that the old aversion had begun to yield to a scientific curiosity and admiration. This interest, culminating in the modern romantic sentiment, was of very slow growth and did not burst forth all at once in Savoy a hundred and fifty years ago, as is so generally assumed.[13] It seems to have

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[10] So Richter, *op. cit.*, and G. Uzielli: "Leonardo da Vinci e le Alpe," *Boll. del Club Alpino Italiano*, Vol. 23, 1890, No. 56; the latter shows that the name Monbosa existed on maps of Monte Rosa as late as 1740 and that a spur of the mountain is still called Monte Bo; he is followed by Douglas Freshfield in his review of Uzielli's article, *Proc. Royal Geogr. Soc.*, Vol. 14, 1892, pp. 345-347, who there recanted his earlier view that it was Monte Viso (*ibid.*, June, 1884); Freshfield believes the painter reached the Col d'Ollen, 10,000 feet. Coolidge: Swiss Travel and Swiss Guide Books, 1889, p. 163, believes the peak in question is the Monbego (9,326 feet), in the Maritime Alps.

[11] See Gribble, *op. cit.*, App. F, p. 272 *seqq.* and translation, *ibid.*, p. 29 *seqq.*

[12] See Encyclopaedia Britannica, 11th edit., 1910-1911, article Popocatepetl; cf. also A. Lunn: The Exploration of the Alps, 1914, Ch. 2, p. 30; he wrongly gives the date of ascent as 1521.

[13] On the growth of interest in the Swiss Alps see the following works:

G. E. von Haller. Bibliothek der Schweizer-Geschichte, Berne, 1785. [For bibliographical details, see Vol. 1.]

B. Studer: Geschichte der physischen Geographie der Schweiz bis 1815, Zurich, 1863. [A marvelous storehouse of facts.]

G. Studer: Ueber Eis und Schnee, Berne, 1869-83. [Contains the best bibliography of Alpine literature.]

J. Frey: Die Alpen im Lichte verschiedener Zeitalter, Berlin, 1877 (No. 274 of Virchow and Holtzendorf's Sammlung gemeinverständlicher wissenschaftlicher Vorträge).

E. Osenbrüggen: Die Entwickelungsgeschichte des Schweizreisens (Ch. 1 of Vol. 1 of his "Wanderstudien aus der Schweiz," Schaffhausen, 1867).

L. Friedländer: Ueber die Entstehung und Entwickelung des Gefühls für das Romantische in der Natur, Leipzig, 1873 (reprinted in Vol. 2, pp. 206-259, of his "Darstellungen aus der Sittengeschichte Roms"). [Contains sketchy summaries of the history down to recent times.]

B. Schwarz: Die Erschliessung der Gebirge, Leipzig, 1885. [Traces the development in detail until the ascent of Mont Blanc by De Saussure in 1787.]

G. Peyer: Geschichte des Reisens in der Schweiz, Basel, 1885.

Sir Leslie Stephen: The Playground of Europe, 1871, Chs. 1 and 2.

Wm. Longman: Modern Mountaineering and the History of Alpine Clubs, *Alpine Journ.*, Vol. 8, 1876-78, suppl., p. 39 *seqq.*

W. A. B. Coolidge: Swiss Travel and Swiss Guide Books, 1889. [Important work, already mentioned in footnote 10; frequently used as a source in this part of the present paper.]

W. A. B. Coolidge: The Alps in Nature, 1898. [The best work on all phases of the Alps, sporting, social, political, and historical.]

Francis Gribble: The Early Mountaineers, 1899. [Already mentioned in footnote 2; the most readable book on the pioneers of Alpine travel.]

Francis Gribble: The Story of Alpine Climbing, 1904. [Smaller work.]

Arnold Lunn: The Exploration of the Alps, 1914. (Series: Home University Library.)

G. W. Young: Wind and Hill, 1909. [On the poetry of mountaineering.]

Arnold Lunn: The Englishman in the Alps, 1913. [An anthology. Other Alpine anthologies are E. Baker and F. E. Ross: The Voice of the Mountains, 1905; and H. Spender: In Praise of Switzerland, 1912.]

Fig. 1.—Peaks of the Pennine Alps from the Matterhorn hut; from left to right, Obergabelhorn, Rothorn, Weisshorn.

FIG. 2—The seven villages on the Italian side of the Great St. Bernard Pass route.

received great impetus at the foundation of the University of Basel in 1460, when, for the first time, men of scientifically trained minds were brought into contact with the mountains of Switzerland. The earliest work dealing with the Alps is, so far as can be learned, a Latin poem composed by Heinrich Moriti, a member of the Basel faculty and the friend of Erasmus. Soon after its appearance in 1514 we meet with ascents. Thus in 1518 a party of four Swiss[14] visited Lucerne and gained permission of the village authorities to climb Mt. Pilatus, a feat which they accomplished without molestation from the restless spirit of the Roman proconsul supposed to dwell in the waters of a marshy lake near the summit. In keeping with the superstitious nature of the age, the story had grown up that the spirit of the suicide Pilate roamed over the earth until a wandering scholar got its consent to remain quietly in the waters of the lake on the mountain which bears his name. Only on Good Fridays could it rise to the surface; at other times it could be aroused by shouting or throwing stones into the lake, when a convulsion of nature would ensue. Finally the government of Lucerne forbade all strangers to approach the lake; in 1307 six clergymen were imprisoned for breaking this rule.[15]

The earliest important ascent, however, seems to have been made in 1536, when Rhellicanus climbed the Stockhorn near Thun (7,195 feet) and celebrated the undertaking in 130 Latin verses.[16] Five years later Konrad Gesner, a professor at Zurich, indicted a letter to Vogel (Avienus) of Glarus, in which for the first time the modern romantic feeling was expressed. As this letter marks the first real break with the older period of fancied terrors[17] and, therefore, a new epoch in the appreciation of the mountains, the following quotation from it is of interest:

> I am resolved, henceforth, most learned Avienus, that as long as it may please God to grant me life, I will ascend several mountains, or at least one, every year, at the season when the flowers are in their glory, partly for the sake of examining them and partly for the sake of good bodily exercise and of mental delight. For how great a pleasure, think you, is it, how great a delight for a man touched as he ought to be, to wonder at the mass of the mountains as one gazes on their vastness, and to lift up one's head, as it were, amongst the clouds. The understanding is deeply moved, I know not wherefore, by their amazing height, and is driven to think of the Great Architect who made them; etc.[18]

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[14] The party included Vadianus—Joachim von Watt (1484-1551)—of St. Gallen; later in the same year, Duke Ulrich of Würtemberg repeated the ascent. The account of Vadianus is presented in Gesner's tractate, mentioned in footnote 18.

[15] Cf. Coolidge, *op. cit.*, 1889, pp. 11-12; Gribble, *op. cit.*, 1899, p. 45.

[16] J. Müller, professor of "bonarum litterarum" at Berne (in Latin called Rhellicanus, after his native village of Rhelliken, near Zurich), published his "Stockhornias" at Basel in 1537 (appended to his Latin translation of Plutarch's "Life of Homer"); all the Latin text and translation by Gribble, *op. cit.*, 1899, App. G, p. 277 *seqq.* and p. 39 *seqq.*

[17] These terrors for the most part, however, kept up for the next two centuries; the last phase of the older period is marked by the work of G. S. Gruner: Die Eisgebirge des Schweizerlandes, 3 vols., Berne, 1760. A revised edition was published in 2 vols. in 1778 under the title of "Reisen durch die merkwürdigsten Gegenden Helvetiens."

[18] Translated by Coolidge, *op. cit.*, 1889, pp. 12-13. This letter was first published as an introduction to Gesner's tractate "Libellus de lacte, et operibus lactariis, philologus pariter ac medicus," appearing in 1541; later, after ascending Pilatus, in 1555, he included it in his "Descriptio montis Fracti sive montis Pilati"; it was also published at Zurich under the title "Epistola ad Jacobum Avienum de montium admiratione."

But Gesner was not alone in his appreciation of the mountains, as we see from the following quotation from the writings of his friend Marti, professor at Berne:

These are the mountains which form our pleasure and delight when we gaze at them from the highest parts of our city, and admire their mighty peaks and broken crags that threaten to fall at any moment. Who, then, would not admire, love, willingly visit, explore, and climb places of this sort? I should assuredly call those who are not attracted by them dolts, stupid dull fishes, and slow tortoises. . . . I am never happier than on the mountain crests, and there are no wanderings dearer to me than those on the mountains.[19]

In another passage he says he saw many inscriptions cut into stone by climbers on top of the Stockhorn; one in Greek read "The love of the mountains is best."[20]

A similar change in feeling can be traced in contemporaneous art. The medieval painters, like the poets, felt no attraction for mountain scenery. In early Swiss views the spectator almost invariably has his back to the mountains. Dürer and his pupil Altdorfer were the first to show the change in their pictures, and so may be looked upon as the originators of modern landscape painting.[21]

The next important date in tracing the development of the *passion des montagnes* is 1574, the year in which Josias Simler of Zurich published a great commentary on the Alps,[22] in which he gave a detailed description of the Alpine regions and devoted a chapter to the dangers and difficulties of climbing. He gives good advice to the climber, mentioning stocks, ropes, snow-shoes, crampons, and even tobogganing and glissading. He touches on the dangers of crossing snowfields and crevasses, and even mentions the use of black spectacles, "vitrea conspicilia," and burnt cork as a protection against the rays of the sun. In the preface he gives his point of view in the following passage:

The poets figured that the mountains were haunted by many divine beings—Pan, satyrs, fauns, and oreads; Parnassus, Helicon, with many other summits, were sacred to the gods. Doubtless the ancients wished to shadow forth by these fables the works and might of nature, most discernible in the mountains. By us, meanwhile, who cannot explain these riddles, nor indeed greatly desire to do so, it must nevertheless be confessed that lofty mountains are most worthy of deep study. For everywhere you turn, they present to every sense a multitude of objects to excite and delight the mind. They offer problems to our intellect; they amaze our souls. They remind us of the infinite variety of creation, and offer an unequaled field for the observation of the processes of nature.

From this we see that, whereas Gesner was the pioneer of the emotional

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[19] Quoted by Lunn, from Freshfield's translation, *op. cit.*, 1914, pp. 36-37.

[20] Lunn, *op. cit.*, 1914, p. 16.

[21] Dürer, 1471-1528; Altdorfer, died 1538; they were followed by Wolf Huber and Lautensack; cf. E. W. Bredt: Die Alpen und ihre Maler.

[22] "De Alpibus commentarius"; the edition of 1633 also contains his essay entitled "Valesiae descriptio." Simler makes it clear that the habit of visiting the Alps had become fashionable long before the close of the century; he says foreigners from all parts of Europe came to admire the mountains and explains the lack of interest in them among his countrymen as due to familiarity.

literature on the Alps, Simler was the forerunner of the more objective school; though a climber, he personally displayed comparatively little love or enthusiasm for the mountains.

A very similar sentiment is the following expressed by a traveler a few years later:

What, I pray you, is more pleasant, more delectable and more acceptable unto a man than to behold the height of hilles, as it were the very Atlantes of heaven? to admire Hercules his pillers? to see the mountaines Taurus and Caucasus? to view the hill Olympus, the seat of Jupiter? to pass over the Alpes that were broken by Annibal's Vinegar? to climb up the Appenine promontory of Italy? from the hill Ida to behold the rising of the Sunne before the Sunne appears? to visit Pernassus and Helicon, the most celebrated seates of the Muses? Neither indeed is there any hill or hillocke, which doth not containe in it the most sweete memory of worthy matters.[23]

Toward the middle of the seventeenth century the topography of Switzerland was accurately studied by Matthäus Merian and Martin Zeiller.[24] The chief merit of their published work was the seventy-five copperplate views of Swiss towns and castles. Near the end of the century a real guide book of the Alps was issued by the Zurich naturalist Wagner.[25] By the beginning of the eighteenth century Alpine literature was enriched by the labors of J. J. Scheuchzer, a professor at Zurich. In his great work he catalogues in Latin and German all the ranges, peaks, glaciers, passes, villages, and even pasture lands known to him, and supplements this with a mass of information which forms a summary of all that was so far known about the Alps.[26] But he manifested neither the sentimental love of the mountains which we see in Gesner nor the scientific interest of Simler. He must have been a poor mountaineer withal, for in one place he says: "anhelosae quidem sunt scansiones montium," and he failed even to reach the top of Pilatus because of "weariness." Moreover he was a firm believer in the notion already mentioned that dragons inhabited the mountains.

However, by this time only a few passes, as the Gemmi and Grimsel, were well known, and only a few of the lower summits, as Pilatus and the Stockhorn, had been reached. Not until the early eighteenth century did tourists from outside Switzerland visit the Alps in great numbers. Most of them, to be sure, were quite content to view the majesty of the glaciers and peaks from the towns at their bases.[27] But a general awakening to the glory of the higher summits began to be felt toward the middle of the cen-

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[23] In T. Coryate's "Crudities," 1611, already mentioned in footnote 7; quoted by Lunn, *op. cit.*, 1914, p. 15.

[24] "Topographia Helvetiae, Rhaetiae, et Valesiae," Frankfurt, 1642. The text was written by Zeiller and the views were engraved by Merian. Between 1642 and 1688 Merian and his sons issued thirty volumes on the topography of Switzerland; see Coolidge, *op. cit.*, 1889, pp. 20-21.

[25] "Index memorabilium Helvetiae," 1684; a second edition called "Mercurius Helveticus" appeared in 1688.

[26] "Die Beschreibung der Naturgeschichte des Schweizerlandes," Zurich, 1706-08; more fully in his collected works, Leyden, 1723. He published the first accurate map of Switzerland.

[27] Thus we hear of Englishmen being conveyed by carriage from the Channel to Switzerland in sixteen days for twenty guineas.

FIG. 3.

FIG. 4.

FIG. 3—St. Rhémy, on the Italian side of the Great St. Bernard Pass route. The village is protected by woods against avalanches. Along the slope on the left ran the old Roman road, parts of which can still be seen.

FIG. 4—Looking down the Bernina Pass route between La Rösa and Poschiavo.

tury. The earliest recorded snow peak to be ascended was the Titlis, reached in 1739 by a monk of Engelberg.[28] The huge glaciers of Mont Blanc—or Mont Maudit, as it was then called—ever visible from the streets of Geneva sixty miles away, were visited in 1741 by two Englishmen, Pococke and Windham, who may be regarded as the forerunners of the stream of British tourists.[29] The account of the visit of these "discoverers" of Chamonix is ludicrous in the extreme, but gives us an idea of a Swiss mountain village of that day. They entered Chamonix accompanied by a retinue of porters and guides, who were well armed against the "bandits" of the valley, whom they feared so much that they would not enter any house, but bivouacked in the open air.[30]

In 1760 De Saussure, then a young professor at the newly founded Academy in Geneva, visited Chamonix with the express intention of ascending Mont Blanc for scientific purposes. The next year he came again and offered a prize to the man who would find a route to the top. For a quarter of a century various attempts were made to win it, but not until 1786 was a path discovered by the peasant Jacques Balmat, accompanied by Paccard, the village doctor.[31] Scientific interest was the cause of most of the succeeding climbs until past the middle of the nineteenth century. To this category belong the ascent of the Jungfrau in 1811; of the Finsteraarhorn in 1812; of Monte Rosa in 1855; of the Dom in 1858; of the Aletschhorn in 1859; of the Weisshorn and Schreckhorn in 1861; of the Dent Blanche in 1862; and of the Grandes Jorasses and Aiguille Verte (both in the Mont Blanc massif) in 1865, the same year in which the Gabelhorn and Matterhorn were ascended in the Zermatt region. In 1854 an Englishman named Wills made the hazardous climb of the Wetterhorn from the Grindelwald

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[28] The next two were the Buet (10,290 feet) near Chamonix, ascended in 1770 by the brothers Deluc, and the Velan (12,353 feet) in 1779 by Murith, the prior of the Great St. Bernard hospice.

In 1777 there appeared in Berne the first special guide-book to Switzerland, Pastor Wyttenbach's "Instruction pour les Voyageurs qui vont voir les Glaciers et les Alpes du Canton de Berne," in French and German; a second edition, enlarged to forty pages, appeared in 1787. Heidegger's "Handbuch für Reisende durch die Schweiz" appeared at Zurich in 1787-89 and was followed by two other editions, 1790-91 and 1797. It remained the chief Swiss guide-book until the work of Ebel, with which it was incorporated in 1818: for an account of several minor guides appearing between Heidegger's and Ebel's, see Coolidge, *op. cit.*, 1889, p. 37 *seqq.* Ebel's "Anleitung auf die nützlichste und genussvollste Art die Schweiz zu bereisen" appeared at Zurich, 1793, and remained the standard guide until the days of Murray.

[29] Of course Chamonix had been known to the monks of the Benedictine priory there since the thirteenth century. The first authentic date in the history of the valley is 1091, when Aymon, Count of Geneva, bestowed on the Benedictine monastery of St. Michel de la Cluse, near Turin, the "campus munitus."

[30] Cf. Edward Whymper: Guide to Chamonix and the Range of Mont Blanc, 15th edition, 1910, Ch. 1.

[31] As Mont Blanc was the first Swiss district to be minutely explored, the first special guide-book was written about it: "Itinéraire de la vallée de Chamonix," by J. P. Berthout van Berchem, Lausanne, 1790. The artist Bourrit, who had made many attempts to scale Mont Blanc before Balmat's success, wrote an "Itinéraire de Genève, Lausanne et Chamouny," 1791.

As against the story of the ignominious part played by Dr. Paccard in the first ascent of the mountain as promulgated long ago by Dumas in his "Impressions de Voyage," see the true account by H. Dübi: Paccard wider Balmat, oder die Entwickelung einer Legende, Berne, 1913, which is based on the notes of an eyewitness (Baron von Gersdorf) which have recently been discovered in the public library of Görlitz. In the writer's "The Ascent of Mont Blanc," *Natl. Geogr. Mag.*, Vol. 24, 1913, pp. 861-942, the legendary account was followed. For a summary of Dr. Dübi's arguments, see review of his book by Douglas Freshfield in the *Alpine Journ.*, Vol. 27, 1913, pp. 202-209.

side, and so this date is generally taken as the beginning of the passion for mountaineering as a form of healthy and manly sport. Since then it has taken on great dimensions, until now practically every cliff and crag in the Alps has been repeatedly ascended.

Nor should we, in conclusion, overlook the literary influences which, in the eighteenth century, contributed largely to the growth of the romantic sentiment about mountains. The poem by the Swiss physiologist Albrecht von Haller, entitled "Die Alpen" (Berne, 1732), is perhaps the earliest work of this character in the century. But the greatest influence was that exerted by the epoch-making writings of Rousseau, who proclaimed the romantic view of nature in all its phases and especially that of the mountains, which gave a tremendous impetus to the "play-ground" idea of Switzerland. The "Nouvelle Héloïse"[32] is the main exponent of the increasing love of the mountains. In his "Confessions"[33] occurs the well-known passage in which he avows his repugnance to the plains and celebrates the beauty of torrents, rocks, woods, rugged paths, and precipices. The English poet Gray, on the strength of many passages in his letters from the Lake District in 1769, has wrongly been given the honor of having been the first to arouse interest in mountains and mountaineering. Years before (in August, 1741) he had written in the Album of the brothers at the Grande Chartreuse the beautiful Alcaic lines beginning

O Tu, severi Religio loci

in which he first revealed his passion for "niveas rupes" and "fera juga"—

Clivosque praeruptos, sonantes
Inter aquas nemorumque noctem.

He marks the transition from the artificiality of Pope and his followers to the revival in English letters inaugurated by Cowper, Burns, and other poets, toward the end of the century. He shares with Thomson the honor of restoring English poetry to nature. Born and bred within sight of the Cheviot and Lammermuir hills, Thomson was inspired by their rugged scenery, though his musings

On rocks and hills and towers and wandering streams

were at best those of one who still looked upon these features as vague, far away, and gloomy. Macpherson, the author of the poems attributed to Ossian[34] so strangely popular in Europe during the eighteenth century,

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[32] It appeared in 1759; though the sentiment is diffused throughout the book, the leading passage is in Lettre XXIII, wherein the lover retires to the Valais and reflects on his impressions of the mountains and climbing.

[33] The "Confessions," though written from 1766 on, were first published in 1782, four years after the philosopher's death. The famous passage is at the end of Bk. IV: "Au reste, on sait déjà ce que j'entends par un beau pays. Jamais pays de plaine, quelque beau qu'il fût, ne parut tel a mes yeux. Il me faut des torrents, des rochers, des sapins, des bois noirs, des montagnes, des chemins raboteux à monter et à descendre, des précipices à mes côtés qui me fassent bien peur."

[34] "Fragments of Ancient Poetry, collected in the Highlands," appeared in 1760; "Fingal, an Epic Poem in six books," appeared in "Poems of Ossian" in 1762, and also "Temora, an Epic Poem in eight books," in 1763.

first revealed the grandeur of his Scotch Highlands, where mountain, glen, and sea were joined: his descriptions of scenery surely quickened the sense of glory as distinct from the horror of mountain scenery. In consequence the Highlands, previously looked upon as the abode of half-savage men, now began to be visited for pleasure.[35]

The initial impulse given by these lovers of nature was increased by the romantic writers of England.[36] These, both poets and prose authors, were at first content to follow the Greek ideal of the delights of more harmonious scenes, but soon felt the influence of the elemental in both sea and mountain. The greatest of them was Wordsworth, the chief interpreter of nature in all literature.[37] He brought to English ears a new message, which had been but faintly heralded by Thomson and Gray. For before his day English poetry had displayed but little serious interest in the delineation of nature, which was still largely impersonal and objective. Where his predecessors had been content to follow the "pathetic fallacy" and read their own feelings into it, Wordsworth let it speak its own message. Not only the outward aspects, but the very soul of nature is revealed in his poetry. His influence, like that of Rousseau, in making it once more subjective and poetic, cannot be overestimated. It is to these two, then, though they were not the first, that we are mostly indebted for our modern sentimental attitude towards nature, especially for our appreciation of the ruggedness of mountain scenery.

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[35] The usual repugnance to mountain scenery is well seen in the contemporary dictum of Johnson, who thus wrote of his impressions of Highland scenery, which he viewed in 1773 on his famous journey to the Hebrides:—"It will readily occur that this uniformity of barrenness can afford very little amusement to the traveller; that it is easy to sit at home and conceive rocks, heaths and waterfalls, and that these journeys are useless labors, which neither impregnate the imagination nor inform the understanding" (Journey to the Western Isles of Scotland, 1775—the passage before the description of Glensheals). Similar sentiments were expressed by his friend Richardson, in the description of the crossing of the Mont Cenis pass, in "The History of Sir Charles Grandison," 1753, and also by Goldsmith, who, writing from Holland, spoke with disdain of the Scottish scenery which he had just left.

[36] Roughly from 1800 to 1850 (or better perhaps from the American Revolution to the accession of Victoria in 1837).

[37] In 1797 Wordsworth, his sister Dorothy, and Coleridge retired to the Quantock hills of Somerset with the deliberate intention of making literature "interest mankind permanently," which they believed classic poetry could not do. The result of this purpose was "Lyrical Ballads," appearing in 1798, the spirit of which is best reflected in the two chief poems of the volume, "The Rime of the Ancient Mariner" and "Lines Written a Few Miles Above Tintern Abbey."

A MAP OF THE VEGETATION OF THE UNITED STATES

By FORREST SHREVE
Desert Laboratory of the Carnegie Institution, Tucson, Arizona

[With separate map, Pl. III, facing p. 124.]

The plant life of the United States presents some striking diversities, which are obvious enough to the unlettered man and are fraught with the deepest significance to the geographer, who sees in the dissimilar communities of plants the resultants of an interaction of climate, topography, and soil, and the determinants of many of the primal activities of man. The geographical study of an extensive plant population may be undertaken from either of two points of view, both of which are now rather well known to the scientific public. The older of these is concerned with the distribution of species, genera, and families of plants, as constituting phylogenetic entities or floras, while the later point of view has to do with the distribution of those natural assemblages of plants which are called—both popularly and technically—the vegetation. The phases of plant geography which concern the flora and those which concern the vegetation possess much common ground, but from this they lead into widely separated fields of inquiry. The distribution of the flora is to be explained by paleobotany, geology, paleoclimatology, and the history of evolution, wherever that may be read; the distribution of the vegetation is to be accounted for by the facts of plant physiology, climatology, soil physics, and soil chemistry.

An attempt to secure an accurate map of the vegetation of an area, large or small, may be looked upon as an end in itself, and such a map may well possess a value and usefulness *per se*. The interest of the writer in the compilation of the map which is presented herewith (Pl. III) has been, however, to secure a basal delineation of the geographical features of plant distribution in the United States for use in an investigation of the influence of climate on the range of the principal types of vegetation. For this reason it has been particularly important to base the subdivisions and boundaries of the map upon purely vegetational criteria, with complete disregard of climatic, physiographic, geological, floristic, historical, or other considerations.

The vegetational criteria which it is possible to use at the present time in distinguishing the varied plant communities of a large area are partly features of physiological behavior and partly features of anatomical structure. The former are of fundamental importance because it is through them that plants stand in a relation of adjustment to their environment. The latter are of importance because they are reasonably reliable outward indices of the physiological behavior of plants, which still await investiga-

tion. A great deal is known, for instance, about the physiological im portance of the evergreen and deciduous habits in trees, of the microphyl lous and succulent forms in desert plants, and of the root distribution an water requirements of perennial grasses and of desert shrubs. We know very little by direct experimentation about the relative water requirement of the dominant trees in the Northern Mesophytic Evergreen Forest, th Northwestern Hygrophytic Evergreen Forest, and the Western Xerophyti Evergreen Forest. We can infer a difference in their water requirement from their size, rate of growth, the anatomy of their leaves, and the charac ter of the plants associated with them in their natural habitats. We know that the rainfall and general moisture conditions are very different in th regions occupied by these three types of forest, but it would be begging th whole question of the relation of climate to vegetation if we were to use th climate itself as a criterion in differentiating the forests. If the forests ar not unlike in themselves there is no importance in a study of the climati differences which accompany them. This is merely one of the cases in whicl we are thrown back upon general anatomical evidence in distinguishin types of plants on which little physiological work has been done.

The charting of vegetation involves two difficulties at the outset. Th first is bound up with the endless diversity of natural plant communitie and is concerned with the selection of the units which are to be segregate and delimited. The principal feature of this difficulty lies in deciding ho far it may be advisable to subdivide a large group of variable and inte grading entities. The writer has attempted to treat this difficulty in conservative manner, without hesitating, however, to make departures fro the subdivisions that have been used in the few purely vegetational maps o the United States that have been prepared heretofore. Only the larges features of difference between plant communities have been considered, wit a desire to segregate the ones that possess marked features of dissimilarit in the gross physiological character of their dominant plants. It is merel by accident that such communities happen to present landscapes of a ver different sort, although this is a consideration of some geographical inte est. The vegetation recognized for each region is the areally predominan plant-covering of the average upland. The influence of soil characte usually local in its nature, must be ignored in mapping on such a sma scale. It is not to be forgotten, however, that the character of the soil ma occasionally underlie the predominance of a given type of vegetation over large area, as is true of much of the Southeastern Mesophytic Evergree Forest. The so-called climax vegetation is a theoretical concept which ca not be applied to all regions and has little relation to the areally predom nant vegetation even in regions where it can be demonstrated.

The second difficulty to which allusion was made is regarding the draw ing of hard and fast lines between communities which actually intergrad in the most gradual manner. Such gradations are sometimes of so gre

n extent as to justify the recognition of transition regions. In all other ases it is necessary to consider the boundary between two communities as eing of the same nature as isothermal or isobaric lines—merely connecting ll points which possess the same stage in a graduated change.

There is no possible criterion by which it might be maintained or denied hat the regions mapped are of correlative value. They must be taken as nerely representing the most natural subdivisions of the vegetation from a hysiological standpoint.

The sources from which the materials for this map have been gathered re far too numerous for an acknowledgment of them to be made here. The ublications of the Forest Service and the Geological Survey, together with umerous papers on the vegetation of states or of smaller areas, have been xtensively used. Heavy acknowledgments are also due the many botanical olleagues who have furnished information regarding the regions known to hem or have given criticisms on the preliminary drafts of the map.

To those who have a wide familiarity with the vegetation of the United States this map will seem to be of uneven merit, depicting certain regions vith greater accuracy and detail than it exhibits in others. This circumtance is partly due to the irregularity with which the vegetation of our ountry has been studied, and partly to the early disturbance of the virgin orests of the northeastern states, where few records remain as to the distriution of the original types of vegetation. A strong effort has been made o eliminate from consideration all of the changes in our original vegetation vhich are due to human agency. Such changes have left their mark upon he long-settled portions of the desert areas and the grasslands as well as ipon the forests.

The charted areas have been designated by names which primarily describe the character of the vegetation, at the same time that they generally ndicate its geographical location. Such names are neither brief nor convenient but their selection has not been made without reasons. From the standpoint of physiological plant geography it is necessary to avoid the iames for faunal and floristic zones which are in such common use, but are vithout logical scientific basis, as "Upper Sonoran," "Arid Transition"; o avoid the use of morphological terms, such as "coniferous"; and to evade he use of designations which imply that a particular factor is responsible for the existence of a given type of vegetation, as "pinelands of the oölitic imestone," or "monsoon forest."

The primary subdivision of the vegetation which has been made is the old one of desert, grassland, and forest—three types involving plants of very dissimilar size, density of stand, anatomical structure, and physiological behavior. The desert area is differentiated by the respective predominance of succulent or of non-succulent plants, and by the nature of the shrubbery which it presents. The grassland has not been subdivided, but solely through a lack of the data necessary to do so. The intensive study of certain grass

areas has shown the diversity of ecological behavior in these outwardl similar plants, but the distribution of the types of grassland—largely loc and edaphic—is not well enough known for the purpose of mapping. Th forests have been distinguished as deciduous or evergreen, and the latte have been subdivided with respect to their stature, density of stand, folia characters, and subordinate plants. Transition regions have been recognize between the Deciduous Forest and the northern and southern evergree areas. Transitions have also been outlined between the Grassland and it adjacent types of vegetation, the Deciduous Forest and the Succulent Deser In order to simplify the subdivision of the desert as much as possible th Pacific and Texas Semi-Desert areas have not been resolved into their com ponents, and the small areas of encinal in the southwestern border state and the savanna of the Texas coast have been comprised in the Wester Xerophytic Evergreen Forest and in the Grassland—Deciduous-Fores Transition respectively.

An inspection of the map shows that the vegetational areas have, i general, a north-and-south trend more commonly than an east-and-west on This feature suggests that the major differences of vegetation in the Unite States are determined more largely by moisture conditions than by those o temperature. Such a generalization must, however, be made with cautio in view of the fact that the moisture relations of plants have influenced thei external form and their foliar characters much more strongly than thei temperature relations have done, and that, in the present state of our knowl edge, the moisture relations are apt to receive preponderant weight in an attempt to classify vegetation on the basis of its salient physiologica features.

Following are very brief characterizations of the eighteen vegetationa areas of the United States which have been represented on the accompanyin map.

California Microphyll Desert. An extremely low and open stand o microphyllous (small-leaved) shrubs, chiefly evergreen but partly deciduous very poor in grasses and in succulent plants. The dominant plants ar creosote bush (*Covillea tridentata*) and sand bur (*Franseria dumosa*).

Great Basin Microphyll Desert. An open stand of shrubs, sometime nearly closed; varying from place to place in stature; usually poor in grasse and succulents. The dominant plant is sage brush (*Artemisia tridentata*) locally accompanied by other forms.

Texas Succulent Desert. A mixed stand of microphyllous shrubs an succulent and semi-succulent plants. The shrubs are either evergree (*Covillea*) or deciduous (*Acacia, Flourensia*). The stem-succulents com prise many species of cacti, chiefly low in growth; the commonest leaf succulent is lechuguilla (*Agave lechuguilla*); the semi-succulents includ sotol (*Dasylirion texanum*), amole, and palmilla (*Yucca*).

Arizona Succulent Desert. A mixed stand of microphyllous shrubs small trees, either evergreen or deciduous, and of succulent forms, chiefly e stem-succulent cacti. The leading shrubs are creosote bush and cat-claw *Acacia*); the commonest small trees are palo verde (*Parkinsonia*) and palo rro (*Olneya*). The succulents comprise large columnar forms (*Carnegiea*), branching arborescent forms (*Opuntia*), and many smaller types.

Texas Semi-Desert (Mesquital-Grassland Complex). An open or closed and of small trees and shrubs, chiefly deciduous, with local areas of grassnd and a representation of succulents. The dominant tree is mesquite *Prosopis glandulosa*); the principal shrub, huisache (*Acacia farnesiana*).

Pacific Semi-Desert (Encinal-Chaparral-Desert Complex). A region great topographic diversity in which the vegetation varies locally from ncinal (open oak forest, chiefly evergreen), through chaparral (a closed rub of evergreen shrubs), to desert (ephemeral herbaceous plants, small erennials, local succulents). The principal evergreen oaks are encina *Quercus agrifolia*), maul oak (*Q. chrysolepis*), and highland oak (*Q. islizeni*); the principal chaparral plants are chamiso (*Adenostoma fasciculatum*) and species of manzanita (*Arctostaphylos*).

Desert-Grassland Transition. A region intermediate in character beveen the Grassland and the Succulent Deserts of Texas and Arizona. An pen carpet of perennial grasses and ephemeral or root-perennial herbaceous lants, with a more or less sparing representation of succulent and semiucculent forms. The leading Grassland plants are the gramas (*Bouteloua*) nd galleta grass (*Hilaria*), and the chief Desert plants are palmilla, amole, nd a small group of cacti.

Grassland. The vast plains area, covered by a more or less closed sod of erennial grasses, becoming more open toward the south and toward the orthwest, where the bunch-grasses are predominant. A scattering repreentation of desert forms is present, particularly in the "bad lands," hrubs are locally present in portions of the area, and the evergreen forests dvance from the west onto hills and rocky soil, while the Deciduous Forest ncroaches from the east through the valleys of the largest streams. A umber of species of herbaceous perennials are found in all parts of the Grassland, being chiefly Composites. The leading grasses are the gramas *Bouteloua*), buffalo grass (*Bulbilis dactyloides*), and prairie grass (*Koeleria cristata*).

Grassland—Deciduous-Forest Transition. The rather ill-defined belt n which the Deciduous Forest emerges from the flood-plains and river nargins and occupies a portion of the upland. On the western edge of the elt there is a high percentage of grassland, while in the eastern portion he deciduous forest becomes nearly continuous. The principal trees of this egion are the bur, white, and black oaks (*Quercus macrocarpa, Q. alba, Q.*

velutina); the principal grasses, beard grass (*Andropogon furcatus*), Indian grass (*Sorghastrum nutans*), and dropseed (*Sporobolus cryptandrus*).

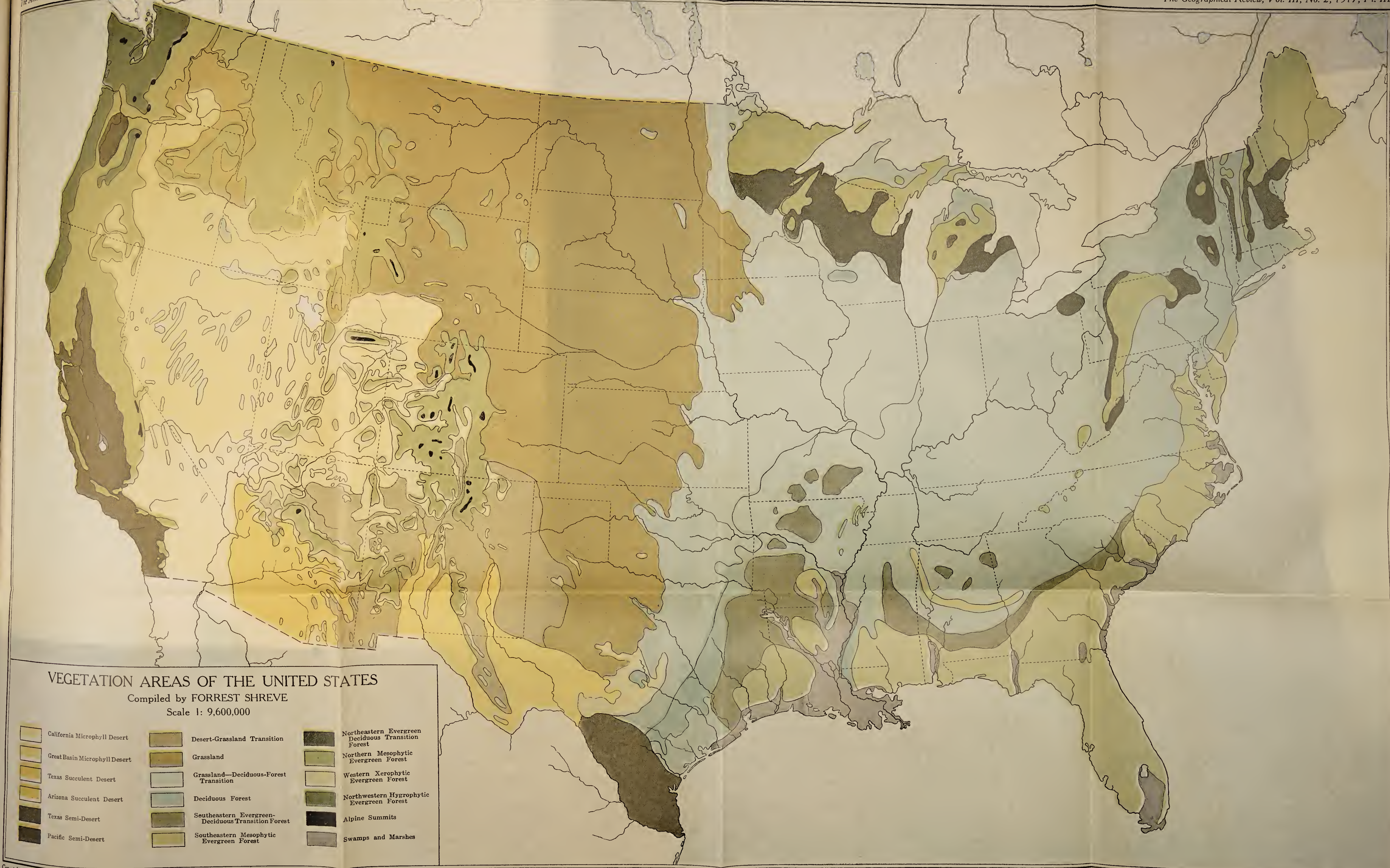
Deciduous Forest. The extensive area in the Mississippi valley and southern Appalachians which was formerly occupied by an almost unbroken forest of a score or more of deciduous trees. A few prairies occur in the southern portion of the area, and evergreen needle-leaved trees occupy bluffs and shallow soil in the mountains. The commonest trees are species of oak (*Quercus*), hickory (*Hicoria*), chestnut (*Castanea*), beech (*Fagus*), maple (*Acer*), walnut (*Juglans*), tulip (*Liriodendron*), and ash (*Fraxinus*).

Southeastern Evergreen-Deciduous Transition Forest. The area in which there is a nearly equal commingling of the deciduous and evergreen species of the adjacent regions. Local bodies of purely deciduous or purely evergreen forest are determined by soil conditions. The commonest evergreen trees are the loblolly pine (*Pinus taeda*) and the scrub pine (*P. echinata*), and the commonest deciduous trees are post oak (*Quercus minor*), Spanish oak (*Q. digitata*), and blue jack oak (*Q. brevifolia*).

Southeastern Mesophytic Evergreen Forest. The coastal plain forest of evergreen needle-leaved trees, with a subordinate admixture of evergreen broad-leaved and deciduous species. Extensive areas of this forest are pure stands of long-leaf pine (*Pinus palustris*) or Cuban pine (*P. caribaea*) in open formation, with a clear floor nearly devoid of shrubs and carpeted with grasses and herbaceous plants.

Northeastern Evergreen-Deciduous Transition Forest. A region in which the trees of the Deciduous Forest area and those of the eastern portion of the Northern Mesophytic Evergreen Forest are intermingled in nearly equal proportions. A very common type of forest in this region is that in which maple (*Acer saccharum*), beech (*Fagus atropunicea*), and hemlock (*Tsuga canadensis*) are dominant.

Northern Mesophytic Evergreen Forest. This extensive region is characterized throughout by a pure or nearly pure stand of needle-leaved evergreen trees, among which deciduous trees are often present either as minor components of the forest or else as trees of lower stature. Virgin stands of this forest range from 60 to 125 feet in height and vary from open park-like formations to heavy forest with a completely shaded floor. The heaviest stands are almost devoid of shrubby undergrowth, but the more open ones are accompanied by deciduous shrubs and under-trees. In spite of the essential identity of this forest from the Pacific to the Atlantic it is nevertheless made up of a large number of tree species. Very many extensive areas are formed by a single species and many others by an admixture in which not more than three or four species are involved. In the western half of the area the yellow pine (*Pinus ponderosa*), the lodgepole


VEGETATION AREAS OF THE UNITED STATES
Compiled by FORREST SHREVE
Scale 1: 9,600,000
California Microphyll Desert
Great Basin Microphyll Desert
Texas Succulent Desert
Arizona Succulent Desert
Texas Semi-Desert
Pacific Semi-Desert
Desert-Grassland Transition
Grassland
Grassland—Deciduous-Forest Transition
Deciduous Forest
Southeastern Evergreen-Deciduous Transition Forest
Southeastern Mesophytic Evergreen Forest
Northeastern Evergreen Deciduous Transition Forest
Northern Mesophytic Evergreen Forest
Western Xerophytic Evergreen Forest
Northwestern Hygrophytic Evergreen Forest
Alpine Summits
Swamps and Marshes

ne (*P. murrayana*), and the red fir (*Pseudotsuga mucronata*) are the ees which dominate the most extensive stands. In the eastern portion of e area the white pine (*P. strobus*), the hemlock (*Tsuga canadensis*), the ck pine (*P. divaricata*), and the balsam fir (*Abies balsamea*) are the most mmon species.

Western Xerophytic Evergreen Forest. An open forest of low stature, e trees seldom exceeding 40 feet in height. The needle-leaved and scale-aved evergreens are the dominant trees, but the forest is everywhere ac-mpanied by shrubbery and by some succulent or semi-succulent plants, id is carpeted in many localities by an open growth of perennial grasses. long the Mexican boundary this forest merges into the encinal, or ever-reen oak type. The dominant species of the Xerophytic Evergreen Forest iry from state to state but are in almost all cases either junipers or piñons.

Northwestern Hygrophytic Evergreen Forest. A well-marked type forest characterized by density of stand and by the size of its trees, which ommonly reach 100 to 125 feet in height and are often in excess of this. he floor of the forest is heavily shaded and supports relatively few decidu-is under-trees, although there is usually a rich growth of shrubs and of rns, mosses, and other herbaceous plants. The trees which characterize iis area are the red fir (*Pseudotsuga mucronata*), redwood (*Sequoia mpervirens*), black hemlock (*Tsuga mertensiana*), red cedar (*Thuja licata*), white fir (*Abies grandis*), and others.

Alpine Summits. The portions of the higher mountains which lie above mber line, characterized by a very scant growth of stunted or prostrate ees, by mats of alpine herbaceous plants, or merely by mosses and lichens.

Swamps and Marshes. The swamps are composed of evergreen and eciduous trees in great variety, the bald cypress (*Taxodium distichum*) nd tupelo (*Nyssa*) being the commonest forms. The marshes are widely arying areas of grasses, sedges, and emersed aquatic plants.

THE INFLUENCE OF WEATHER ON STREET-CAR TRAFFIC IN DULUTH, MINNESOTA

By EUGENE VAN CLEEF

If street-railway companies could estimate their daily traffic twenty four to thirty-six hours in advance they could effect a great saving o money for themselves and could give the public improved service. How ever, a forecast seems impossible when one considers the many differen factors likely to influence the traveling public. An analysis of the possibl influences shows the weather to be the largest single factor. Yet just hov effective it is and the manner in which its changes are reflected in passenge traffic have remained unknown. Through the courtesy of the officials of th street-railway company of Duluth, Minnesota, who have made availabl

Weather Report and Key to Units Representing Weather Conditions

Time	Temperature Plus	Temperature —	Units	Condition of Atmosphere	Key
5 a. m.	48	108	148	Clear	Rain or Snow—0 Plus degrees temperature
12 m.	58	30	88	Cloudy	Cloudy Sky – 30 Plus " "
6 p. m.	46	60	106	Partly Cloudy	Part Cloudy Sky—60 Plus " "
12 p. m.	42	0	42	Rain	Clear Sky – 100 Plus " "

........384..........Total Units for 24 hours ending at midnight.

FIG. 1—Facsimile of blank form used by the street-car company of Duluth, Minn., to recor "weather units."

The figures in the second column under "Temperature" are intended to express, not temperatur but the "condition of the atmosphere" according to the key given in the last column. The first figur should read 100.

the requisite data and have very kindly co-operated in this work, it ha become possible to compare the variations in passenger traffic in that cit with fluctuations in daily weather conditions. Duluth was selected fo this study for the following reasons: (1) the number of people who wal to and from work in the mornings and evenings, respectively, is quit large; (2) the number who walk home for lunch and then walk or rid back to their place of business is unusually large; (3) the public as whole is especially given to long walks, or "hikes"; (4) the love for out door life has hardened many people to all varieties of weather; (5) th writer is well acquainted with the community and its peculiarities.

On inquiring at the offices of the street-car company as to its interes in the significance of weather influences upon its traffic, it was learne that it had become concerned in this vital matter many years ago. Fo twenty years it had kept such a record. Observations for temperatur precipitation, and cloudiness are made by the car-starter located approxi mately in the center of the city and entered on what are termed "weathe unit" blanks, a sample of which is shown in Figure 1. The thermomete used has been of mediocre quality and has not always had the prope

exposure. To the temperature is added a number indicating the condition of the atmosphere in an arbitrary scale ranging from 0 when precipitation occurs to 100 for a clear sky. The total number of units indicates the relative quality of the day: if they are high the day is a good one; if low it is not so good. No absolute standard of reference has been calculated. The figures are compared with a sort of sensible average, dependent upon the season of the year. For example, 384 units, as given in Figure 1, represent a poor April day, whereas 450 units would represent a very fair day for that season. In so far as the scheme takes into account three of the most common elements, temperature, precipitation, and cloudiness, it possesses merit; it lacks, however, the fourth very common factor, the

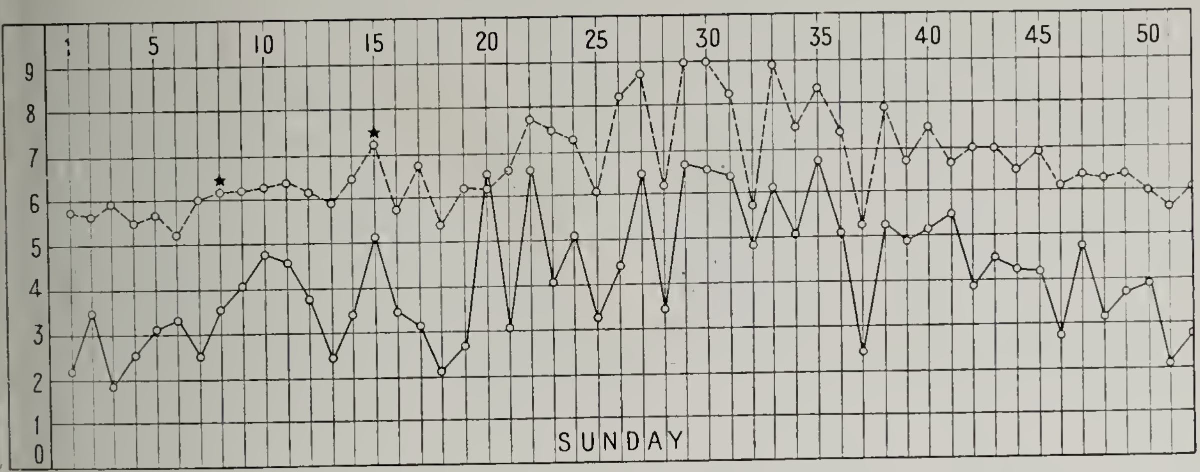


FIG. 2—Diagram showing the relation of street-car traffic to weather in Duluth, Minn., on Sundays during 1914.

The dotted curve represents passengers per mile per day. The continuous curve represents "weather units" as calculated by the street-railway company. The numerals at the top of the vertical lines indicate the number of the week in the year. The figures at the left of the horizontal lines represent the passengers per mile in units and at the same time the "weather units" in hundreds. The stars refer to holidays or other special occasions.

wind. These records are now kept only as tradition. At one time they were observed rather closely in the hope that they might reveal information which would aid the company to run its system more efficiently both for the public and for itself.

To afford a proper basis for this investigation the total number of passengers carried was reduced to terms of the number of passengers carried per mile per day and plotted with the weather units. These data were plotted with reference to the respective days of the week, i. e. all the Sundays of the year were grouped in one curve, the Mondays in another, and so on. It is obvious that to compare a Sunday with a Monday would be illogical, the former a day when most of the business world rests, in contrast with the latter, a day of great activity. It would be just as bad to compare any other two days of the week, since the business world inclines toward the performance of different kinds of business on different days. Figure 2 illustrates the curves for Sunday only. The parallelism of these

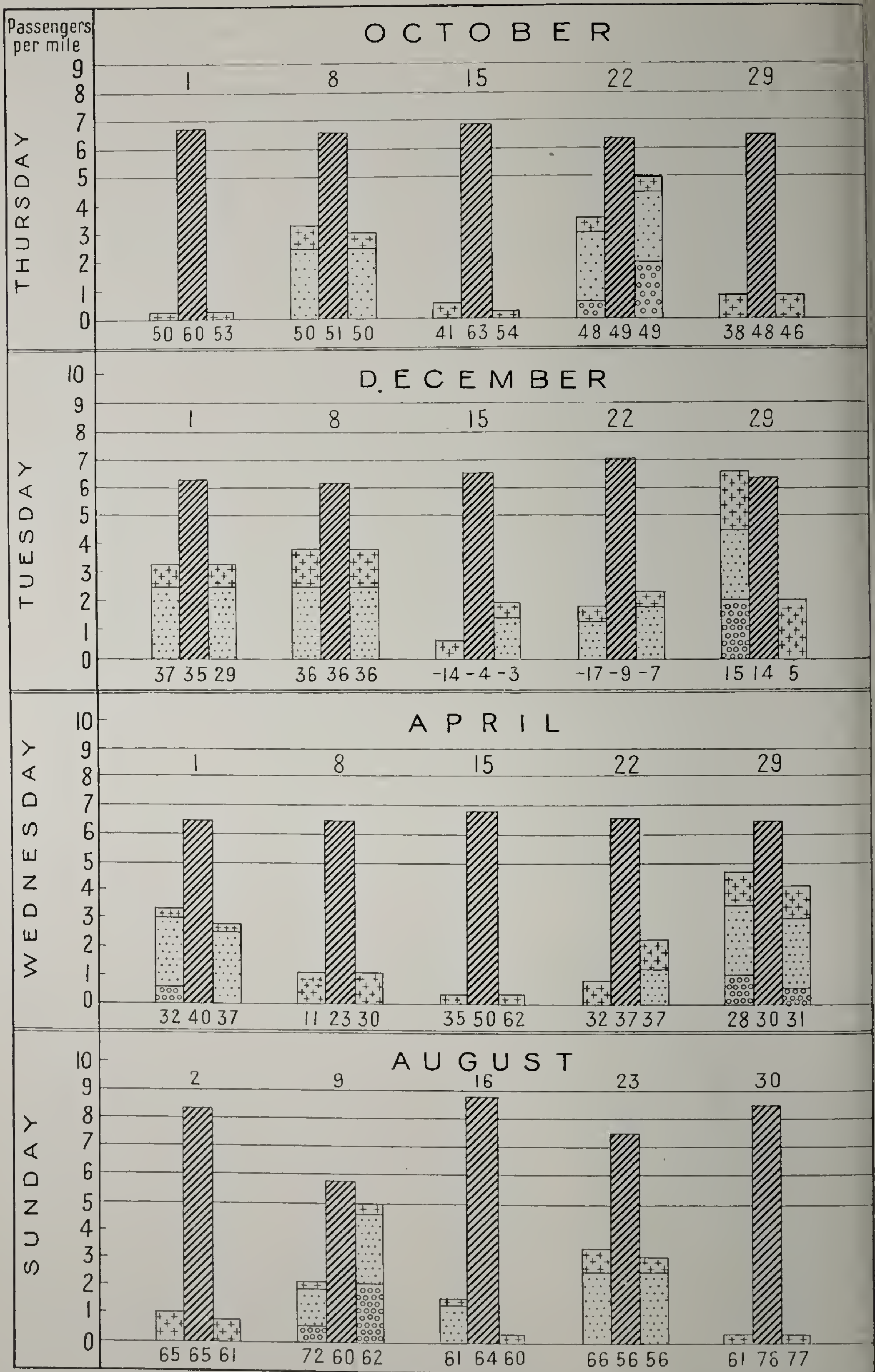


FIG. 3—Diagram showing the relation between the specific weather elements and the street-car traffic in Duluth, Minn., on selected days at different seasons in 1914. (For explanation, see bottom of p. 129.)

curves is striking. (It is similar for the other days of the week, though not quite so emphatic.) Even where the variation in the passenger curve is slight, as at the left of the diagram, its meaning is none the less important. The variation oftentimes represents only one-tenth of a passenger per mile per day. When the average number of miles run per day amounts to 9,539, as it does for Tuesdays, for example, a difference of one-tenth of a passenger per mile means 953.9 passengers per day, and the fare which they pay equals $47.69. This decrease in traffic may be the equivalent of an actual loss to the company. Such a loss occurring on very many days may mount into the thousands of dollars and soon prove serious. Hence the tenths earn a right to as much respect as the whole numbers. Clearly, then, so far as revealed by the curves in Figure 2, weather and traffic are closely related. In very few instances does the parallelism break down. But nothing in these curves indicates what elements exert the greatest influence or whether perhaps all are of equal significance. Hence the problem really begins here.

The year 1914 was selected in this initial effort to solve the problem because it approaches very nearly the ideal. The weather was not unusual; no strikes occurred, and "jitneys" had not yet made their appearance. It seemed at first as though many years of data would be necessary for conclusive evidence; but the results thus far have proved so substantial that one normal year has been accepted as affording a satisfactory basis for work for the present.

How to plot the data for ready comparison presented a small problem in itself. Temperature, precipitation, wind velocity, and cloudiness were the elements chosen as those which probably exert the maximum influence. Humidity would hardly be effective in a region like that of Duluth, where days of great heat combined with high humidity are rare. The combination of high humidity and cold winds, producing "raw" weather, is also uncommon. Sunshine is the complement of cloudiness and therefore appears automatically in the figures for cloudiness. Special phenomena such as thunderstorms, blizzards, and severe rainstorms are not incorporated in the graphs but are accounted for in the detailed weather record from which the figures for the graphs were taken.

The day was divided into morning (A. M.) and afternoon (P. M.), and the average condition for these respective periods was recorded. In the case of temperature the figures were taken at three periods—7 A. M., 12 noon, and 6 P. M., the hours when the traffic is heaviest. In Figure 3

Explanation of Fig. 3—The heavily shaded central column in each group represents the number of passengers carried per mile according to the scale on the left, on the day indicated by the date above. The outer columns in each group represent, according to their symbols: precipitation (small circles), cloudiness (dots), and wind velocity (crosses), the left-hand column indicating prevailing conditions between 7 A.M. and 12 M, and the right-hand column those between 12 M. and 6 P. M.

The unit of scale for these elements is one-fourth the passenger mile unit on the left of the diagram. One such unit represents one unit in a scale of ten for cloudiness and wind velocity; for precipitation the scale is: trace, 2 units; light, 4; heavy, 8.

The three figures below each group of columns represent the temperature at 7 A. M., 12 M., and 6 P. M., respectively, reading from left to right.

extracts from the original charts are given, to illustrate the scheme for plotting the data. This method brings six items at once before the eye of the reader: the date, passengers per mile per day, temperature, precipitation, winds, and cloudiness. In the original charts the months were grouped as follows: December-January-February, March-April-May, June-July-August, and September-October-November, approximating rather closely to the true seasons in this vicinity. Accordingly seasonal phenomena could be easily observed. The second triad of months can hardly be termed spring in this region. A more proper designation is "transition season," which will be used hereafter. Holidays and other special days[1] were eliminated from consideration, although the influence of the weather even on these occasions is readily detected.

The relation of traffic to weather could be better shown if figures were available for the morning traffic as distinct from that of the afternoon. Again, if the data for the non-working travelers were at hand the problem would be very much simplified. The workers who travel regularly each day represent the constant, the others the variable. But since none of the above data have been compiled or are even possible of compilation one must try to recognize in the figures at hand the resolution of the constant and the variable.

The average of the number of passengers carried per mile per day for the respective days of the week was calculated in order to ascertain the daily variation in traffic for the seasons. The results are given in Table I.

TABLE I—AVERAGE NUMBER OF STREET-CAR PASSENGERS CARRIED IN DULUTH, MINN. PER MILE PER DAY FOR EACH DAY OF THE WEEK AND FOR EACH OF THE FOUR SEASONS, 1914

	DEC.-JAN.-FEB.	MAR.-APR.-MAY	JUNE-JULY-AUG.	SEPT.-OCT.-NOV.
Sunday	5.9	6.2	8.3	6.7
Monday	6.1	6.5	7.0	6.6
Tuesday	6.2	6.5	7.2	6.5
Wednesday	6.2	6.5	7.2	6.6
Thursday	6.3	6.6	7.1	6.7
Friday	6.1	6.5	6.9	6.5
Saturday	6.9	7.4	7.8	7.4

These averages are employed as representative of the normal passenger traffic. For example, 6.2 is taken as the normal number of passengers

[1] January 1 New Year's Day
February 22 Washington's Birthday
March 1 Ski tournament
April 12 Easter Sunday
May 30 Decoration Day
June 11 Animal show
June 24 Swedish carnival
July 4 Independence Day
July 23 Circus
August 13 Grocers' and butchers' picnic
September 6 Labor Day
September 11 Industrial exposition
October 31 Halloween
November 26 Thanksgiving Day
December 25 Christmas Day

carried per mile per day on each of the Sundays during the transition season. Table II illustrates how certain comparisons were made. In the

TABLE II—ILLUSTRATION OF THE METHOD USED TO DETERMINE THE FACTORS WHICH INFLUENCE STREET-CAR TRAFFIC IN DULUTH, MINN.

	±	T	P	W	C	H	P.C.
June 5	—	×	....	×	....	....	6.5
12	—	×	....	....	....	....	6.8
19	—	×	....	×	....	....	6.8
26	—	×	×	×	....	....	6.7
July 3	+	....	×	....	....	×	8.6
10	—	×	....	×	....	....	6.6
17	—	×	....	Calm	....	....	6.8
24	+	×	....	"	....	....	7.2
31	+	×	....	....	....	....	7.3
Aug. 7	+	×	....	....	....	....	7.0
14	+	....	....	×	....	....	7.0
21	+	×	....	....	....	....	7.1
28	—	×	....	×	....	....	6.7
					Average for the season		6.9

Abbreviations—
— Decrease + Increase
T—Temperature P—Precipitation
W—Wind C—Clouds
H—Holiday P. C.—Passengers carried per mile

first column opposite the dates is indicated the deviation in the number of passengers from the normal (6.9 for the season) by a minus (—) sign or a plus (+) sign, according to the sense of the deviation. Under the other column headings a cross-mark (×) occurs according as the particular element or elements seemed to be the determining cause of the deviation. Decreases were primarily considered. One must necessarily be more interested in a decrease in passengers, since this means reduced profits. Finally, the crosses in the respective columns were added together. In 118 days when a decrease occurred wind figured 70 times, temperature 56, precipitation 51, and clouds 29. These elements played a part either independently or in combination. From these results it would appear that wind is the most influential factor. During this period there occurred a total decrease in traffic of 33.3 passengers per mile or .28 passenger per mile per day. If the average daily mileage is 9,546.7 (this figure excludes Sundays, for which the mileage averages 9,043.4), then the total reduction in receipts per day amounts to $133.65, or, for 118 days, $15,770.70. surely an amount worth trying to save.

An analytical study of the statistics and charts develops five well-defined conditions which may cause a decrease in traffic. (The references to Figure 3 are meant only to illustrate and not to prove the assertions.)

(1) Precipitation is practically always effective excepting when it occurs in the form of a light snow unaccompanied by wind. Light snow in itself seems to have little influence. In Figure 3 compare October 22 with October 8, days differing essentially only in their precipitation.

(2) Precipitation accompanied by a strong wind is more effective than if accompanied by a weak wind.

(3) Other elements being the same or very similar, a considerable drop in temperature will reduce traffic.

(4) Even when other elements are dissimilar, a decided drop in temperature reduces traffic that would otherwise assume normal proportions or even rise above the normal. In Figure 3 compare April 8 and 22. They differ primarily in temperature.

(5) A moderate to strong wind, usually 4 or above (Beaufort scale), reduces the number of passengers. In Figure 3 compare December 1 and 8. The drop in patronage can be only accounted for on the basis of wind.

Cloudiness has a slight tendency to decrease traffic. The evidence, however, is not fully convincing. Fogs, as one would expect, cause a reduction. Heavy storms, either of snow or sleet, or thunderstorms are reflected in the passenger returns.

The various factors assume the following order (the most effective first) with respect to their capacity for reducing traffic:

(1) Precipitation accompanied by wind;

(2) Precipitation alone, except light snow;

(3) A considerable drop in temperature accompanied by a moderate to strong wind;

(4) A strong wind—most effective when in combination;

(5) A decided drop in temperature regardless of other elements.

A few apparent anomalies occur. In one instance a high wind accompanying low temperature seemed to be the cause of an increase in traffic. On another occasion a heavily drifting snow failed to produce a decrease in patronage; and in three other cases a high wind accompanying a moderately high temperature increased traffic. A possible explanation of the last situation may be that the warmth of the day lured people out of doors who subsequently were driven to the cars by the unpleasantly high wind. Furthermore, the department stores report that, in the event of a three-day storm, their receipts go up on the third day, in spite of unfavorable weather. People become tired of remaining indoors so long and venture forth in spite of the weather. These anomalies are cited to indicate some of the complications that arise when one endeavors to formulate a rigid rule with regard to weather influences.

If the five weather factors given above are correct they should prove up in a traffic forecast. One hundred such forecasts were made covering the period from March 23 to July 12, 1914, inclusive.[2] The street-railway company considers an estimate involving an error of not more than 3.3 per cent as practically exact. If the error is not more than 5 per cent, the estimate is still very good. The average deviation of the forecasts from the average daily traffic was 2,155, or within 3.2 per cent of the correct figure. This error falls well within the limits set by the company. But since averages so often cover up a great many details of importance, certain absolute figures are presented.

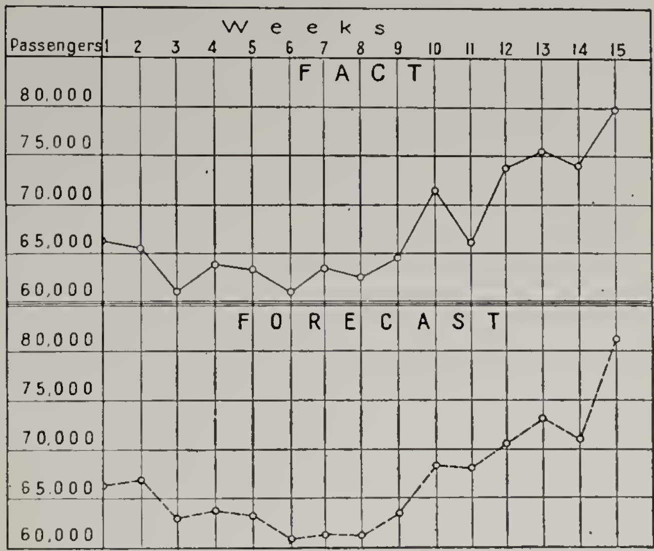


FIG. 4—Diagram showing the agreement between the forecast and the actual figures of street-car traffic in Duluth, Minn., for a period of 15 weeks from March 23 to July 12, 1914.

The smallest error for any given day was 33 on a day when 67,147 passengers were carried, and the largest error was 8,918 when 80,235 passengers were carried. On the latter day a convention of uncertain attendance led to an estimate far too low. The following tabulation gives the percentage of the total number of forecasts for which the error ranged between zero and a specified maximum:

0 to 2500	64%	0 to 4000	82%
0 " 3000	68"	0 " 4500	87"
0 " 3500	80"	0 " 5000	91"

The average daily traffic for the period was 67,548. Using 5 per cent as the maximum error which may enter into the forecast without seriously diminishing its value, the efficiency percentage reaches 79; in other words, in 79 cases out of 100 the error falls under 5 per cent. If an error of 15 per cent in weather forecasts is recognized as permissible, an error admitted by the U. S. Weather Bureau, then the efficiency of the traffic forecasts becomes evident.

The latter half of the forecast period was disturbed by the appearance of the "jitney" after its winter hibernation, by the uncertainty of enforcement of a threatened ordinance regulating it, and by the opening of an extension of the street-railway lines. In spite of these disturbances the average of accuracy was maintained. The influences that produce variations in the traffic returns are many. Yet none seem so powerful as the

[2] This period includes 112 days. The weather map was not available on 12 days, hence no forecast was attempted.

weather. The curves in Figure 4 indicate how well the variations in the forecast agree with the facts.

The investigation was started with a hope merely to demonstrate positively that weather influences passenger traffic to a degree greater than most persons are aware and to make some exact determinations of the character of that influence. It was hardly expected that the results would lead to the ability to forecast traffic. The case is only one of many in the domain of climatology which convince one that the time must come when direct application of the knowledge of the weather influences upon man's daily activities will constitute the normal method of procedure.

IS THE ATLANTIC COAST SINKING?

By DOUGLAS W. JOHNSON

More than half a century ago Professor George H. Cook, then state geologist of New Jersey, presented striking and apparently convincing evidence that the Atlantic coast of North America was gradually subsiding at the rate of two feet per century. Farm lands under cultivation fifty years before were, at the time of his investigation, covered with salt marsh grasses; old corduroy roads were encountered several feet below the surfaces of salt marshes at many points along the shore; and, within the memory of men then living, the ocean waters had risen so high upon the wheels of tidal mills that their operation had become difficult or impossible. The scientific manner in which Professor Cook presented his arguments gained for him not only the respect of geologists in all parts of the world but a very general acceptance of his interesting conclusions.

Independent investigation of the shores of England, southern Scandinavia, the Netherlands, and France convinced many geologists in those countries that the Atlantic coast of Europe was suffering a subsidence similar to that of the North American coast. On both sides of the North Atlantic, therefore, there has long existed a conviction that the land is slowly but surely sinking beneath the ocean waters. In America in particular it has been accepted as a well-established fact that a subsidence of from one to two feet per century is still in progress.

On various occasions the writer has discussed the supposed evidences of recent coastal subsidence along the Atlantic coast of the United States and southeastern Canada, and has presented reasons for believing that the so-called proofs of land sinking within historic times were open to alternative explanations, whereas the physiographic evidence could only be explained by postulating long-continued coastal stability. Studies on the eastern and southeastern coasts of England, the coast of Holland, and the coast of southern Sweden indicated that in like manner the supposed proofs of recent subsidence in those regions were open to criticism, while the physiography of the English and Swedish coasts furnished convincing evidence that the relative level of land and sea had not changed appreciably for many hundreds of years. A careful study of numerous reports by French observers detailing the evidence of a recent progressive subsidence of the western coast of France led to the conclusion that this evidence was not of such a character as to establish the subsidence theory; but the writer made no personal examination of this coast.

The apparent evidences of subsidence are so striking, and the conclusions in favor of recent coastal stability, in the localities in question, are so radically opposed to the long-held opinions of most geologists and geog-

raphers, that it will be profitable to review briefly some of the latest contributions to this interesting problem. We may mention first some foreign studies and then return to investigations of our own coast.

Professor Jules Welsch of the University of Poitiers has recently applied to the study of the western coast of France the same methods of interpretation outlined in the writer's "Fixité de la côte Atlantique de l'Amérique du Nord"[1] and has published his conclusions in a paper entitled "Fixité de la côte du Centre-Ouest de la France."[2] This clearly written and well-illustrated report analyzes at length the supposed proofs of recent subsidence upon which earlier investigators have placed reliance, criticizes other evidence which led certain students to infer a recent elevation of the land, and finally presents physiographic evidence of long-continued coastal stability. His conclusion is expressed in the words, "There is no proof of a submergence or an emergence of the coast since the Neolithic epoch, that is to say, during the last few thousand years."

In a paper on "Den Formodede Littorina-Saenkning i Norge"[3] Professor Hans Reusch discusses supposed proofs of a late post-glacial subsidence of Norway, particularly of the southern part of the coast. The evidence is largely in the form of submerged peat deposits, such as have frequently been cited by American students as indicating recent subsidence of our own coast. Professor Reusch shows that in each case the field relations are easily susceptible of an alternative explanation.

The Report of Progress of the Ordnance Survey of Great Britain, detailing operations up to March 31, 1916, contains results of precise leveling which are pertinent to the present discussion. I quote the following from the section on geodesy: "In the year 1837-38 a line of accurate leveling was executed by Mr. Bunt, in order to compare the mean sea-level of the Bristol Channel with that of the English Channel, and also to enable subsequent leveling to determine whether there had been any vertical movements of the land surface. . . . . . In the year under review, 78 years after the original operation, the line was very carefully releveled. . . . . . The difference between the two results for the length of 58.87 miles between Perry Farm and Axmouth is 1.12 inches. . . . . . The probable error of the new geodetic leveling from Perry Farm to Axmouth, as calculated from the discrepancies between fore and back leveling, is 0.17 inch. The probable error of Doctor Whewell's leveling of the same line, calculated in the same way, works out at 1.88 inches. . . . . . The chief result of the comparison is that there is no indication that there has been any change in the relative levels of the coast lines of the Bristol Channel and English Channel during the 78 years that have elapsed since Doctor Whewell's leveling was carried out."

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[1] *Annal. de Géogr.*, Vol. 21, 1912, pp. 193-212.

[2] *Annal. de Géogr.*, Vol. 23, 1914, pp. 193-218.

[3] *Norges Geol. Undersök. Aarbok*, 1915, Art. 4, 19 pp.

In the Summary Report of the Geological Survey of Canada for the ear 1914, published in 1916, there is a synopsis of the results secured y Professor J. W. Goldthwait in his physiographic work in Nova Scotia. 'rom this it appears that Professor Goldthwait examined the old fortress t Louisburg, the position of which is so often asserted to prove a recent inking of the land. The present writer had previously secured a report pon this locality through an assistant, Dr. Donald Barton, who was unable o find any evidence of a change of level in the vicinity of the fort. Proessor Goldthwait reaches the conclusion that "there has been no sinking r rising of the coast at this place during the last two centuries."

Dr. D. S. McIntosh, professor of geology in Dalhousie University, Haliax, has just published an interesting article entitled "A Study of the Cow Bay Beaches."[4] A number of drumlins near Halifax have been eroded by the ea, and with portions of the erosion products the waves have constructed series of beach ridges. Examination of the rings of growth of stumps on he oldest ridge fixes its minimum age at about 150 years. Inasmuch as he crest of the oldest beach ridge has about the same altitude as that of he modern ridge, the author concludes that "these beaches are the effect f waves upon a stationary coast—one which has remained so for at least hundred and fifty years."

A paper by Dr. J. W. Spencer on "Postglacial Earth-Movements about Lake Ontario and the Saint Lawrence River"[5] contains a section on the "present stability of the lake region," in which occurs a table of the mean ifferences of level between two permanent benchmarks at Port Colborne nd Cleveland, 160 miles apart, as deduced from the daily records of lakeevel for a period of 57 years. Such a table is of interest because of the ossibility, or even probability, that any subsidence or elevation of the and would be accompanied by a warping which would be revealed by a hange in the relative levels of two points so far apart. No such change s apparent. Doctor Spencer concludes: "From a full study it is apparent hat there has been no change of level in 57 years. . . . . . These results lisprove my original suggestion (1894) that the Niagara discharge would e turned into the Mississippi in the not distant future. This idea was xpanded into a monograph on earth-movements by Dr. G. K. Gilbert, who ised the fluctuations of the lakes; but in so doing he took the levels of a ew isolated days, irregularly selected. The erroneous results derived herefrom have been widely quoted, but the table given above contains the proof of the present stability of the lake region."

In connection with his study of the New Jersey coast, the present writer lesired to ascertain whether there had been any warping or tilting of the tate, such as might be expected to accompany the rapid subsidence generally believed to be in progress all along the New Jersey shores. He accord-

[4] *Trans. Nova Scotian Inst. of Sci.*, Vol. 14, 1916, Part I, pp. 109-119.
[5] *Bull. Geol. Soc. of Amer.*, Vol. 24, 1913, pp. 217-228.

ingly suggested to the state geologist the desirability of re-surveying certai lines of precise level in the southern part of the state, where the suppose evidence of subsidence was most striking, in order to determine whethe the relative elevations of Atlantic City, Vineland, and Cape May Cou House, three points of a triangle 30 miles on a side, had undergone an change since the important surveys of 1886. The leveling was done i 1911, and the results published the following year.[6] In the accompanyin table the essential facts are made clear:

Place	Elevations in feet above sea-level		
	1886	1911	Difference
Cape May Court House..........	19.498	(19.498)	0.0
Vineland..........................	108.100	108.082	—0.018
Atlantic City.....................	8.954	8.931	—0.023

The agreement between the levels of 1886 and those of 1911 is extremel close and is well within the limits of the probable error of the observation It is clear, therefore, that there has been no warping or tilting in the soutl ern New Jersey region during the last quarter of a century.

Similar lines of level were run in the northern part of New Jersey i 1915, and the results are summarized in the Annual Report of the Stat Geologist, published the following year. The important conclusion so fa as the present discussion is concerned occurs in the statement: "Durin the period of about 30 years intervening between the several series of level there has been no appreciable change in relative elevations at the seashor and in Sussex and Warren Counties (points from 40 to 50 miles apart) due to tilting of the earth's crust."

Special importance attaches to the results of precise leveling prosecute under the direction of the Chief Engineer of the City of New York i recent years, because the results obtained enable one to determine not onl whether there has been any warping or tilting of the land in the vicinit of New York, but also, with equal certainty, whether or not the land mas as a whole has subsided. The data summarized below are taken from th report on "Precise Leveling in New York City," by Frederick W. Koo published in 1915.

In 1887 a bench-mark on a monument at Perth Amboy was found to b 18.5763 meters above mean sea-level at Sandy Hook, and in that same yea a bench-mark on a sea wall at Willets Point, 33 miles distant to the nortl east, was determined as 4.3083 meters above the same datum plane. In 191 Mr. Koop connected these points by a line of precise levels which showe that the relative positions of the two bench-marks had changed by an appa ent amount of but 1.2 millimeters, or .004 feet. The slight apparent diffe ence is less than the probable error of the earlier survey and proves that o a line 33 miles long no warping or tilting has occurred in the last quarte of a century.

Absolute elevation or subsidence of the land would be detected by con

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[6] Report on Leveling, *Geol. Survey of New Jersey Bull.* 6, pp. 18-21, 1912.

aring the absolute elevations of certain bench-marks in 1887 with the absolute elevations of those same bench-marks in 1911. It is not possible to make ich comparisons with sea-level at the same point, because the tide gage at andy Hook, which furnished the datum plane in 1887, is no longer operating; while the tide gage at Fort Hamilton, which has been used to determine ie modern datum plane, was not operating in 1887. Careful studies have, owever, convinced Mr. Koop that mean sea-level has the same elevation oth at Sandy Hook and Fort Hamilton, so that comparison between the vo surveys can be made with accurate results. The following table gives ie apparent differences in elevation of certain bench-marks after a lapse f 24 years, together with the differences which ought to exist if the land ad been sinking at the rate of 1 foot or 2 feet per century, as commonly ipposed. All differences are expressed in millimeters.

Bench-mark at	*Apparent difference in 24 years*	*Expectable difference, assuming 1 foot subsidence per century*	*Expectable difference, assuming 2 feet subsidence per century*
	mm.	*mm.*	*mm.*
Bay Ridge, Brooklyn	−0.5		
Bath Beach, Brooklyn	−1.2		
East 84th Street, Manhattan	−0.7	73.0	146.0
Willets Point, Long Island	−1.2		
College Point, Long Island	+3.7		

When one considers that the probable error in determining mean sea-evel at Sandy Hook was ±9.1 millimeters, it is seen that all the apparent ifferences are well within the limits of error of observation; whereas the xpectable differences according to the subsidence theory are so great that o errors of observation could obscure the subsidence, were it really in rogress.

If the reader will pardon the personal reference, I will quote Mr. Koop's nal conclusions verbatim: "From the determinations above noted, which re the result of spirit leveling of unquestioned accuracy, it is clear that rom the standpoint of the geodesist or engineer there is no reliable evidence o show a general progressive subsidence of the Atlantic coast in New York City and vicinity. On the contrary, all the evidence is in favor of tability. . . . . . . The work of the writer on the Board of Estimate leveling must be construed as a striking confirmation of Professor Johnson's heory of coastal stability as set forth in the preceding paragraphs. It is of especial interest because it is a proof based on engineering methods of he absolute stability during the last quarter of a century of the very part of the coast which is generally supposed to be undergoing most rapid subsidence at the present time."

THE NEW YORK MEETING OF THE ASSOCIATION OF AMERICAN GEOGRAPHERS

The thirteenth annual meeting of the Association of American Geographers was he in New York, December 28-30, 1916, in connection with the sixty-ninth meeting of t American Association for the Advancement of Science. In spite of the attraction the larger meeting, the interest in the geographical papers was so great that the majori of the members remained in attendance throughout the sessions of the smaller body.

Some thirty papers were read. As the titles and abstracts will ultimately appe in the *Annals of the Association of American Geographers* only a brief general discu sion will be given here.

There were several papers belonging to the domain of mathematical geography a more especially of cartography. Mr. William Bowie of the U. S. Coast and Geodet Survey described the operations of that bureau to determine the intensity of gravi throughout the United States. Since 1909 the network of stations has been great increased, namely from 47 to 260. Professor J. Paul Goode presented a suggestion diminish the marginal distortion prevalent in Mollweide's Projection by interrupti its elliptical shape and projecting each continent on a new central meridian. M Godfrey L. Cabot of the Aëro Club of New England, who spoke on invitatio called attention to the need of maps for aviators in this country and outlined wh had been done in this field abroad. He referred to the final selection by experts Europe of the scale of 1:200,000, or about three miles to the inch, as the best suite to aëronautical purposes. On invitation, Professor Boris P. Weinberg of the Technolo ical Institute of Tomsk, Siberia, spoke on the method of centers. He based his remar on a paper he had recently published in the *Izvestiya of the Imperial Russian G graphical Society* (Vol. 51, 1915). After alluding to the well-known use of the meth by the Bureau of the Census for the determination of centers of area and populatio he exhibited a map showing his own determinations of the movement of the center population and area of the Russion Empire from 1613 to 1913 and compared the with Mendeleyeff's earlier calculations of a similar nature.

Some ten papers were devoted to physiography. A notable feature of this part the program was a group of papers dealing with the extinct lakes of the Great Basi region. Each of the five speakers (Messrs. E. E. Free, J. C. Merriam, Ellsworth Hun ington, D. T. MacDougal, and J. C. Jones) presented a distinct line of evidence bearin upon the origin and age of various lake phenomena in the Southwest. Because of var ous pieces of evidence, among which are the salt deposits, practically all of which a within 150 feet of the surface, Mr. Free's conclusions agree with those of Professo Jones, that the lakes fully occupied their respective basins in recent times and becam extinct within historic times. Doctor Huntington likewise concludes that there hav been marked variations of climate during the past few thousand years. He believ that the rise and fall of the water can be correlated with the more rapid and less rapi growth of the big trees as shown by their rings of growth. On the other hand Professo Merriam can not accept the paleontologic evidences of the extreme modernity of th strand lines. The facts on which the discussion was based will be published in a grou of five papers to appear in an early number of the *Review*.

Professor R. S. Holway of the University of California read a paper on the marin terraces of California. The illustrations were striking. The evidence of warping o relatively recent upraised marine benches along anticlinal and synclinal lines was espe cially noteworthy. Professor George D. Hubbard of Oberlin College gave a bric description of the moraines, eskers, and kames found in 1916 in the southern Gree

ountains near Wilmington, Vermont, which seem to point to the existence of local aciation after the withdrawal of the continental glacier. Dr. R. F. Griggs of Ohio :ate University described his recent visit to the scene of the great eruption in 1912 ' Mt. Katmai at the base of the Alaska Peninsula. The volcano blew its head off in .e great explosion, leaving a caldera three miles long and nearly half a mile deep. n the Bering Sea side of the range a great transverse valley was found where for miles .e ground is full of fissures from which steam issues in thousands of jets.

Three papers dealt with the physical geography of foreign areas. Professor nmanuel de Martonne of the Sorbonne, visiting French professor at Columbia Univer-ty, read a paper on the physiography of the Carpathian Mountains, conceived to :tend from the Danube at Vienna to the Danube at the Iron Gates, i. e. including the ·ction generally known as the Transylvanian Alps. The salient points of his paper are ntained in an article which will be published in a forthcoming number of the *Review*. rofessor W. H. Hobbs of the University of Michigan discussed sand blast erosion and :flation in the shaping of the oases of the Libyan Desert. He called attention to the ıct, also referred to by Professor Jefferson in his article on Utah in the May, 1916, ımber of the *Review* (pp. 347-349), that many oases are great flat-floored and steep-mmed depressions in the desert and not merely spots where water occurs and vegetation ourishes. He also pointed out the necessity for bearing in mind the mechanism of ·osion in arid regions in any general scheme of erosional processes, as we tend to be ıduly influenced by the evidence of erosion in humid regions, with which we are more ımiliar. Tahiti and its coral reefs were the subject of a paper by Professor W. M. avis of Harvard University. The spurs of the two volcanoes which form the island re truncated in maturely aligned sea cliffs. The island is surrounded by a barrier :ef. The sea cliffs must have been cut under conditions which prevented the forma-on of reefs, and since then new conditions must have been introduced as a result of hich the growth of reefs has been possible. The cause of the change from the condition f cliff cutting to those of reef growth is found in a moderate submergence of the island.

Three papers dealt with aspects of American climatology. Professor R. DeC. Ward f Harvard University discussed the rainfall types of the United States. Fourteen ypes were distinguished, and each was illustrated by a composite curve of the monthly ıinfall amounts. A map showed the areal distribution of these types. Professor A. J. Ienry of the U. S. Weather Bureau spoke on the flood-producing rains of 1916 in the 'nited States. The torrential rains in southern California, in Arkansas, Missouri, and ıe lower Ohio valley were described, as well as the two tropical storms which visited ıe East Gulf and South Atlantic States in July. Dr. C. F. Brooks of Yale University ealt with the snowfall of New England. The amount of snowfall in any given section ; dependent on its exposure to the snow-bearing winds, northeast from the Atlantic for he greater part of the region and westerly from the Great Lakes in the northern part. 'he highlands are the snowiest because they are cold, moist, and windy; the intermon-ıne valleys have less snowfall because of the higher temperature, smaller precipitation, nd less exposure. In the coastal region, since the other conditions are favorable, the ıowfall depends on the temperatures. The two last-named papers will appear in orthcoming numbers of the *Review*.

Plant geography was represented by three papers. Messrs. H. L. Shantz and Raphael on of the Forest Service submitted in manuscript their new map of the vegetation of ıe United States. This map will form a plate in the atlas of American agriculture ı preparation by the U. S. Department of Agriculture. The authors discussed the rinciple of classification used, Mr. Shantz having compiled the non-forested and Mr. Zon he forested areas. In another paper, Dr. R. M. Harper discussed the past, present, and uture of the forests of the eastern United States. In the last two hundred years the orest area east of the Great Plains, originally occupying seven-eighths of that territory, as been reduced about 40 per cent and the total stand of timber about 60 per cent.

The predictions of the early exhaustion of the forests, the author said, had nearly alwa turned out to be exaggerated. The influences tending to preserve the trees seem a present to be nearly equal to the destructive influences. A paper on plant successio after glacial recession mainly in Glacier Bay, southeastern Alaska, was read by M W. S. Cooper. Glacier Bay is especially favorable for such study because of the rapi recession which has taken place there during the last century and a quarter, a move ment which has been accurately determined several times during recent years.

In the domain of human geography, one of the most interesting features of th program was a symposium on the geography of the war conducted by Professor D. W Johnson of Columbia University on the evening of December 29. Professor Johnso himself contributed an introduction to the subject. He was followed by a number o speakers who discussed various aspects of the war on land, on water, and in the ai as follows: S. W. Cushing, The Plains of Northern France; Lawrence Martin, River and Marshes of the Eastern Front; Ellsworth Huntington, The Danube Valley and th Balkan Complex; Emmanuel de Martonne, The Carpathian Mountains and Transy vanian Alps; J. Paul Goode, Geographic Aspects of the War on Water; R. DeC. Ward Geographic Aspects of the War in the Air; J. Russell Smith, Economic Geography of th War. The papers all brought out the fact, referred to in his introduction by Professo Johnson, that, in spite of the remarkable development in means of transportation an the general machinery of war, geographical conditions still have a dominant influenc in warfare.

General anthropogeography was represented by a paper by Professor R. H. Whit beck of the University of Wisconsin on the influence of geographic environment o primitive religions. He pointed out how the environment of each was reflected in th mythology and religious beliefs of the Norseman, the Mohammedan, the America Indian, and the ancient Egyptian, and alluded to the gradual making-over of th mythology of the early Aryan invaders of India after they had come under the influenc of the monsoon climate, so different from that of their arid Bactrian home. Th decreasing influence of environment as the scale of civilization rises was also referred to and to this circumstance was ascribed in part the absence of a marked geograph influence in the mythology of Greece and Rome, and in part to the absence of a dominan geographic fact such as the Nile in Egypt, the desert in Arabia, or the monsoon in India. A local example of the influence of nature on man in India was afforded by Mr. S. W. Cushing's paper on Srīharikota, a long narrow sandy island off the Coromande Coast north of Madras, and its primitive inhabitants, the Yānādis.

American topics in anthropogeography were variously represented. Professor Mark Jefferson in his presidential address pointed out how the distribution of cities reflecte the broader economic divisions of the United States. He displayed a striking ma showing, by different symbols, the location and size of all cities from 1,000 inhabitant up. Similar maps were exhibited for the British Isles and India. These two afforde a graphic contrast between an industrial and an agricultural population. A relate topic was treated by Mr. Lawrence V. Roth of Harvard University in a paper o geographic and historic factors in the growth of the more important American cities The movement of population towards the larger cities in the United States falls int four periods, each introducing a new geographic area. The first period begins with our Colonial history, and the development of cities takes place along the Atlantic coasta plain; during the second era, beginning about 1810, city growth is most notable in the Mississippi valley along the river fronts; beginning about 1850 a third era opens, an the cities of the Great Lakes district have a notable growth; during the fourth period opening about 1900, a relatively sudden movement of population is found on the Pacifi coast. Professor Collier Cobb of the University of North Carolina read an interest ing paper on colonial transportation in North Carolina, pointing out how in many case the roads of the time have become the present routes of the trunk-line railroads.

In the field of commercial geography, Mr. A. E. Parkins of the Peabody Col-ge for Teachers at Nashville, Tenn., discussed the development of manufactures at etroit. An interesting point brought out was that the present characteristic industry the city, the manufacture of automobiles, cannot be ascribed to geographic influence. is rather due to the inertia of an industry whose origin there was more or less bitrary. Examples of this kind are worth noting as a warning against laying undue ress on the potency of geographic influence, especially as regards economic phenomena, hich are often purely man-made. Mr. W. G. Reed of the U. S. Department of Agricul-re spoke on ''Plimsoll's Mark,'' the load-line painted on the vessels of the leading a-faring nations. The various positions prescribed for placing this mark according the different oceans and the different seasons reflect the recognition of climatic fluences in this domain of commerce.

The meetings were held in the rooms of the Department of Geology at Columbia niversity. Some forty members of the Association attended, and the general attend-ice of members and non-members was between forty and eighty. In another building ı exhibit of recent maps, particularly of the European war, had been arranged by olumbia University and the American Geographical Society. A relief model, with no ertical exaggeration, of the Mt. Washington Range in the White Mountains was also chibited by Professor J. W. Goldthwait of Dartmouth College, on which the cirques e has called attention to in recent papers were clearly discernible. At a business eeting Professor W. M. Davis introduced the suggestion that the Asssociation appoint committee to co-operate with the National Research Council, and after consideration ie Council recommended the following two resolutions, which were adopted at the usiness meeting of December 30, 1916:

Resolved: That the Association of American Geographers endorse the plan of the [ational Research Council presented to the Association by Professor Davis and promise o-operation.

Resolved: That the Council be authorized to designate representatives from among he members of the Association of American Geographers as members of a co-operating ommittee.

'he Council thereupon authorized the retiring president, the president-elect, and the ecretary-elect (Messrs. Jefferson, Ward, and Dodge) to appoint from among the iembers of the Association a committee to co-operate with the National Research ouncil.

Luncheon, served in the geological laboratory, and dinner, provided at a long-table t the headquarters hotel of the Association, afforded opportunities for social inter-ourse. The meeting closed with the reading and adoption by unanimous vote of a esolution of thanks for the hospitality extended to the Association by Columbia Jniversity.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Annual Reports of the Society; Meetings of January. The annual meeting o the American Geographical Society was held on Tuesday evening, January 23, at th Engineering Societies' Building, 29 West Thirty-ninth Street. President Greenoug presided. The annual reports of the Council, of the Treasurer, and of the Special Com mittee were read, as follows:

REPORT OF THE COUNCIL

January 18, 1917.

To the Fellows of the American Geographical Society:

In presenting a report of activities for the past year the Council is gratified to b able to record that the Society is in all its departments more prosperous than at an time in its history. Its membership has received a very notable increase owing t accessions to Fellowship from all over the country, including amongst the numbe many individuals distinguished in private and public life. This marked developmen is particularly pleasing as evidence that the work of the Society is worth doing an that it is being well done. The most important divisions of this work may be describe as (1) the *Geographical Review,* (2) special publications, (3) lectures, and (4) th library, through one or all of which the Society comes in contact with the public an with its Fellows.

The *Geographical Review,* the monthly publication of the Society, aims to inform it readers of the chief developments throughout the world relating to geographica science. It likewise attempts by its reviews to give an adequate summary of principa works in the field to which it is devoted, and to embody in each number one or tw more popular essays by eminent writers and geographers. The Society has receive abundant and gratifying evidence that the *Geographical Review* has met an importan need on the part of scholars and teachers throughout the country, to reach whom is on of the important functions of the organization. The black-and-white maps illustratin every number and the colored maps, like those published in November and December have been the most notable single improvement in the publication. The response on th part of our readers has been gratifying and we have received the highest commendatio for the excellence of the maps, the originality of treatment they displayed, and th evidence they give of important geographical research.

In carrying out its educational aims the Society has sought the advice of teacher of geography and especially those in the public schools of New York. Already a com mittee of organization has been appointed by the twenty-five teachers who, with th Acting Superintendent of Schools, met at the Society's building in December to discus ways and means for promoting co-operation and for putting at the disposal of educa tional agencies the vast stores of book and map material the Society has been gatherin for years. From time to time this committee will make recommendations which it i hoped will have far-reaching importance in improving geographical education not only in New York but throughout the country.

In line with this action is the interest of the American Geographical Society in aiding the work of the National Council of Geography Teachers. The aims of this new organization are praiseworthy and its field of service so broad that every encouragemen should be given it.

The Society has begun the publication, through Henry Holt and Company, of special books that are commanding wide attention. It is planned to have them writter in a style that will appeal to the general reader, and at the same time to the explorer traveler, and professional geographer. Every book will be a real contribution to the modern science of geography. The series will include reprints of geographical classics and also first printings of explorers' journals and rare manuscripts, as well as works of original scholarship. The series will consist of at least one volume a year, the first volume having appeared in December, 1916. They will be distributed without charge to all members indicating a desire to receive them. One of the most striking features of these books will be the excellence of the illustrations. The best drafting skill will be combined with superior engraving to produce authoritative maps. Moreover, the maps will be distinctive and will represent discoveries in the fields of exploration and research.

The first book of the series is "The Andes of Southern Peru," by Dr. Isaiah Bowan, Director of the Society. It is an interpretation of human life and character in ome of the most famous regions of South America made during an expedition of hich he was geographer. The book is illustrated by nearly one hundred photographs id over one hundred maps, sketches, and diagrams. Among the illustrations are some ery striking photographs of country hitherto unknown to geographical science and even topographic maps in color, the result of a survey of over two hundred miles across ie lofty snow-capped Maritime Cordillera of Peru.

The lectures have been arranged bi-monthly during the winter season to include ddresses by eminent speakers upon subjects attracting popular interest. The attendance at the lectures is necessarily confined for the most part to a New York City ommunity, but they attracted a constant and liberal attendance. The lecturers for ie past season comprise the following: Frederick I. Monsen, Samuel Alden Perrine, ames Barnes, Frederic Poole, Leo Wiener, B. R. Baumgardt, John Paul Goode, Harriet halmers Adams (April 25 and November 21, 1916), Charles Wellington Furlong, and rthur Stanley Riggs.

Additions to the library during the past year comprise 1,881 books and pamphlets, ,448 periodicals, 40 atlases, and 2,826 sheet maps. The Society aspires to maintain a ollection devoted to geographical research which shall be equal to any in the country nd to this end it is believed each year makes distinct progress.

The number of Fellows at the date of this report is 2,787, showing an increase uring the year of 1,636. The number of Life Fellows is 373.

The David Livingstone Gold Medal, founded by the Hispanic Society of America, as awarded by the American Geographical Society to Sir Douglas Mawson in recogniion of his distinguished labors in connection with the Australasian Antarctic Expeition.

The Association of American Geographers met in joint session with our Society durng two days, April 14 and 15, 1916. The gathering was attended by a very large umber of the leading geographers of the country, and the papers and proceedings vere of permanent value. The *Annals* of the Association, which are printed and disributed by our Society, command an increased circulation and esteem among scientists.

The report of the Treasurer of the Society for the year acccompanies this report nd shows current revenues and expenditures. Various special donations have been eceived from friends of the Society which have enabled it to add to the permanent alue of its work. The Society's collection of maps and documents of contemporary nterest have been open to the public each day of the year with the exception of three rincipal holidays and have been made use of very largely by visitors and students.

The members of the staff have been efficient and zealous and have responded willngly to the somewhat increased labors caused by the enlargement of the Society's ublications and the increase in its membership.

Respectfully submitted on behalf of the Council John Greenough
Chairman

Report of the Treasurer for 1916

On January 1, 1916, there was on hand in general account.....		$1,257.43	
Unexpended donations		2,369.59	$3,627.02
During the year there have been received from fellowship dues, sales of publications, interest on investments, and donations applied to general purposes..........................		$42,605.22	
Donations for special purposes..............................		12,888.30	
Mortgages paid off............................	$13,600		
Less reinvested	13,000	600.00	
Dues for 1917 paid in advance..............................		13,780.00	69,873.52
			$73,500.54
There have been expended for salaries, meetings, purchase of books and maps, library, publications, house expenses, insurance, postage, etc..		$42,609.87	
Special donations expended..................................		12,864.76	55,474.63
Balance on hand, December 31, 1916 — in general account.....		$15,032.78	
special donations		2,393.13	$18,025.91
uninvested funds		600.00	

Henry Parish, Jr.
Treasurer

Report of the Special Committee

New York, January 18, 1917.

The Special Committee appointed December 21, 1916, to nominate and invite suitabl persons to fill vacancies in the offices of the Society existing at the date of its annua meeting in January, 1917, respectfully report that they recommend the election of th following gentlemen to the offices designated:

		TERM TO EXPIRE I
President	John Greenough	1918
Vice-President	Paul Tuckerman	1920
Domestic Corresponding Secretary	Archibald D. Russell	1920
Treasurer	Henry Parish, Jr.	1918
Councilors	Charles H. Tweed	1920
	Madison Grant	1920
	Grenville Kane	1920
	Allison V. Armour	1920
	Hamilton Rice	1920

Hamilton Fish Kean
Archer M. Huntington } *Committee*
Chandler Robbins

The reports of the Council and the Treasurer were approved and ordered on file The persons recommended by the Special Committee for the offices to be filled received the unanimous vote of the Society and were declared duly elected.

President Greenough thereupon submitted for confirmation the names of 104 candidates for Fellowship, each of whom had been approved by the Council, and they were confirmed as Fellows of the Society.

The lecture for the evening was entitled "Recent Explorations in Northern Brazil" by Dr. William Curtis Farabee of the University of Pennsylvania Museum. Doctor Farabee is a real "wilderness explorer," to use Colonel Roosevelt's phrase. In the past ten years there have been but two or three others who have done equally extensive and original work in the Amazon basin. Doctor Farabee's description of new tribes hitherto wholly unknown to white men were of absorbing interest, and scarcely less interesting were his photographs and accounts of the physical features of the region back of the Guianas which he was the first to explore. A note on his expedition will be found below under "South America." The published account of his work should be of great value to geographical science, and it is a source of satisfaction that the *Review* is soon to have a paper on some of the results of this noteworthy expedition.

At an extra inter-monthly meeting on January 9, Dr. Eric Mjöberg of Stockholm addressed the Society on "Exploration in Northern Queensland." Doctor Mjöberg described the results of his recent expedition to this tropical part of Australia, an occasion which provided the incentive and at the same time the experience for his proposed expedition to New Guinea, outlined in the first pages of this number of the *Review*. Doctor Mjöberg's lecture was in part illustrated by some remarkable moving pictures of the natives of Australia.

Appointment of an Assistant Librarian. Mr. George M. McBride has been appointed Assistant Librarian on the staff of the American Geographical Society and will begin his duties on July 1, 1917. Mr. McBride was for several years Director of the American Institute at La Paz, Bolivia. His interests are mainly in the field of South American geography.

NORTH AMERICA

Industrial Invasion of the Kentucky Mountains. At last modern industrialism threatens to penetrate the fastnesses of the Kentucky Mountains. Since the days of a thriving trade in salt and iron and of through traffic between the Blue Grass country and Ohio and the Atlantic seaboard this wild mountain region has preserved its early characteristics in a very complete isolation from the rest of the world. In 1910 the population of the 35 mountain counties, totaling over 560,000, included less than one-half of one per cent foreign-born. Most of the small number of foreigners were skilled miners, foreign farmers being practically unknown. Now, attracted thither chiefly by lumber and coal, outside capital is coming into the district and bringing south-European labor in its train. The insignificant urban population is growing. Jenkins, at the foot of the "Trail of the Lonesome Pine," shows the spectacular growth that in its day

urked the rise of Gary, Indiana. But the native population, the independent land-ning farmers, do not adapt readily to these changing conditions. Some retreat still arer the headwaters of the streams; many who remain are degraded in the competi-on for which they are ill prepared. A restriction of the rapid exploitation is strongly ged (B. H. Schockel: Changing Conditions in the Kentucky Mountains, *Scientific onthly,* August, 1916).

Settlement of the Boundary Dispute between Ohio and Michigan. In 1787, ongress passed an ordinance which freed the Northwest Territory from the claims of e Eastern States. A curious mistake arose, however, through ignorance of the geogra-ıy of the territory adjoining the southern waters of the Great Lakes. The maps 1787 showed Lake Michigan north of its real location with reference to Lake Erie, that when the framers of the Ordinance of 1787 decided on establishing a boundary hich would run in an east-and-west line from the southern end of Lake Michigan to ie shores of Lake Erie, they were presumably under the impression that the line would ave to Ohio Territory Maumee Bay with the settlement and port that later became the ty of Toledo. (The text of the boundary ordinance may be found in Henry Gannett's The Boundaries of the United States,'' etc., 3rd edit., *U. S. Geol. Survey Bull. 226,* 904). In 1802, however, suspicion regarding exact conditions was awakened when the onstitution of the state of Ohio was being framed, and a proviso was added to the ew constitution whereby the northern state boundary was to be run in a direct line rom the northernmost cape of Maumee Bay. This proviso satisfied the people of Ohio, ut in Michigan Territory the inhabitants insisted on adherence to the original text of ie Ordinance of 1787. The ensuing controversy was not settled until 1915, when a oint boundary commission was appointed for the purpose of undertaking a permanent elimitation.

An article in *Engineering News* for December 28, 1916 (pp. 1234-1235), enumerates ie various surveys and gives details as to the methods of procedure used. The first urvey of the disputed territory had been made in 1817. Resurveys were undertaken 1 1837 and 1842. A reconnaisance of the line in the summer of 1915 showed that one of the monuments erected in the course of the early surveys existed. Nevertheless t was decided to relocate the line as originally staked out on the ground rather than o run a straight line from end to end. Existing features such as fences and highways ere accepted when agreed to by landowners on both sides as being the state line. In ddition the notes of the three earlier surveys were available, and points were located ith reference to the nearest section and quarter-section corners as given in these otes. The final boundary line has now been permanently marked by a line of granite ionuments. The completion of the surveys was celebrated under the auspices of the Toledo Engineering Society on November 24, 1915.

Reclamation Work in Central Florida. Construction work is about to begin on he drainage of the upper St. John's valley, central Florida (*Bull. Atlantic Deeper Waterways Assoc.,* Oct., 1916). The area covered by the scheme embraces about 265,000 cres of overflow lands now unavailable for agriculture. According to the accepted roject natural drainage lines will be reversed, three main canals being cut to the salt vaters of Indian River, the lagoon back of Cape Canaveral. With subsidiary canals here will thus be created 250 miles of inland waterways. Completion of the work, said to be the largest undertaking of its kind in the South, is anticipated in about two years.

A New Railroad through the Coast Range in Oregon. The Willamette Pacific Railroad, a line built through the Coast Range in Oregon from the Willamette Valley to the Pacific Ocean, was opened to traffic for its entire length in August, 1916 (W. P. Hardesty, *Engin. News,* Jan. 11, 1917). The road is 121.6 miles long and connects Eugene, on the main line of the Southern Pacific Railway between San Francisco and Portland, with Marshfield on Coos Bay. This makes it the sixth transverse railroad leading from the Willamette-Puget Sound depression to the ocean other than the two that follow the natural break of the Columbia River through the barrier of the Coast Range. The ocean terminals of these six railroads from north to south are: Marshfield, Yaquina, and Tillamook, Ore., and South Bend, Aberdeen, and Hoquiam, Wash., the last two on Gray's Harbor.

The new road runs nearly west from Eugene for about 70 miles until the coast region is reached, first piercing the backbone of the range in a tunnel 2,489 feet long and 579 feet above sea level at its western end and then following the valley of the Siuslaw River. From here the road turns south and parallels the coast 3 to 6 miles inland along a string of fresh-water lakes until Marshfield is reached. Marshfield, which

lies on the southern side of Coos Bay, is reached over a steel bridge almost a mile in length.

Besides stimulating the development of the district it traverses, the new line will afford the coal of the Coos Bay region a rail outlet to market.

The Local Name of Lassen Peak. In the December, 1916, *Review* (pp. 464-465) a note appeared stating that the correct name of the volcano in the Cascade Range whose recent return to activity has brought it into prominence was Lassen Peak. This was based, as there indicated, on a decision of the U. S. Geographic Board and a short article in *U. S. Geological Survey Press Bulletin No. 294.* With reference to the note in the *Review* the Society has received from one of its Fellows, Mr. Andrew H. Palmer of San Francisco, an interesting communication concerning the local usage of the name. On a trip last year he had occasion to visit towns on all sides of the mountain and made it a point to interview the people of the neighborhood. All told he spoke with about one hundred persons. Invariably, he writes, the person interviewed referred to the mountain as "Mount Lassen" and not as "Lassen Peak." The following incident, writes Mr. Palmer, is significant. "One day last May, while traveling by automobile stage from Weaverville to Redding, I asked the chauffeur if that was 'Lassen Peak' off on the eastern horizon. 'No,' said he, 'that is Mount Lassen.' He was perfectly serious and had never before heard of 'Lassen Peak.'" The fact that the newspaper despatches generally use the form "Mount Lassen" also reflects local usage, says Mr. Palmer, as these despatches originate with newspaper correspondents who are residents of that region.

These evidences of local usage are interesting. That local usage is the factor first to be considered in deciding as to the proper name of geographical features is obvious. Nevertheless, it need not be the determining factor, as a local name may be, so to speak, a colloquialism. Local usage, less likely to bear in mind the broader relations of the parts to the whole, may be sound as to the name of a creek or ridge and not as to the river or mountain system to which each respectively belongs. That the U. S. Geographic Board is keenly alive, however, to the claims of local usage may be gathered from the following quotations from its latest, fourth, report, published in 1916:

"The Board is agreed that in general the name which is in common local use at present should be adopted. This is a broad, general principle, and summarizes the policy of the Board, with the exception of certain classes of names" (p. 14). . . . . "Especially does it seek after, and it generally obtains, the local usage, to which it attaches great importance. Local usage is usually obtained by correspondence with county clerks, postmasters, and residents who are conversant with local conditions. This information derived from correspondence is often supplemented by the oral testimony of individuals having personal knowledge of the name under consideration" (p. 21).

Transplantation of Chinese Fruit Trees to the United States. Agricultural exploration in China has enabled Frank N. Meyer of the U. S. Department of Agriculture to come to some interesting conclusions regarding the adaptability of Chinese fruits and vegetables to United States soil. Mr. Meyer's three journeys, made between 1905 and 1915, were chiefly conducted in the north and east of the country and the region adjoining. A résumé of his results in the *Yearbook of the Department of Agriculture for 1915* (pp. 205-224) indicates that a number of Chinese plants have already been acclimated in this country, where several climatic provinces find close counterparts in the region of the explorations. Many of the Asiatic varieties can be made to yield promising crops. Among these is the Chinese jujube, the dried fruit of which is exported from Shantung to South China. This tree can be grown in the semi-arid sections of our South and Southwest and possibly in southern Kansas and Nebraska. The Oriental persimmon is likewise adaptable to the Southwest; a thriving industry is centered around the cultivation of this fruit in China.

The large Chinese haw of the region around Taianfu in Shantung appears to be appropriate to those sections of our South which lie beyond the range of the apple. The productive area is a region of deficient rainfall where the winds bring scorching dryness as they blow. Nevertheless the Chinese have succeeded in developing large-fruited forms from the wild small-fruited prototype.

A type of tree practically unknown in the western hemisphere is the *yang-mae*, which bears a much appreciated fruit resembling somewhat the strawberry. This variety can be made to grow along the Gulf Coast and the milder portions of the Pacific Coast. Among ornamental trees the case is cited of a Manchurian elm, also found in North China, which thrives in alkaline soil and is not adversely affected by drought. As a shade tree and windbreak this variety bears promise of successful use in North Dakota and sections of the upper Mississippi Valley.

SOUTH AMERICA

Dr. W. C. Farabee's Explorations in the Amazon Basin, 1913-1916. In conection with Dr. W. C. Farabee's recent lecture before the Society (see above, under 'American Geographical Society'') a brief summary of his explorations is here given, ıainly based on data kindly furnished by Dr. G. B. Gordon, Director of the University f Pennsylvania Museum. Notices of various phases of the trip have already appeared ı these pages and elsewhere (*Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 369-370, Vol. 6, 1914, pp. 441 and 530-531; *Geogr. Rev.*, Vol. 1, 1916, p. 143; *Univ. of Pennsylvania Iuseum Journ.*, Vol. 6, 1915, pp. 1-54).

The expedition, whose objects were mainly ethnological, was sent out by the Uniersity of Pennsylvania Museum. Dr. William Curtis Farabee was the leader. He was bsent in the field for over three years, from March, 1913, to June, 1916. The expediion visited four widely scattered areas, mainly in the Amazon basin: (1) the Guiana ighlands, (2) the Ucayali River in Peru, one of the main source-streams of the ımazon, (3) the island of Marajó, at the mouth of the Amazon, and (4) the region in orth-central Brazil between the Tapajoz and Xingú Rivers, two of the main right ributaries of the Amazon.

The expedition to the Guiana highlands lasted from about the middle of 1913 to ıpril, 1914. Proceeding from Manaos via the lower Negro, Doctor Farabee ascended he Rio Branco, its main tributary, to its upper reaches, where it flows due east, nstead of south-southwest, as in its lower course, and is known as the Uraricoera. The Jraricoera was ascended in canoes until the numerous rapids made further progress npossible. The point attained was three canoe journeys beyond the highest point eached by white men, thus evidently above the point at which Dr. Koch-Grünberg, the erman ethnologist, left the river in 1912 to cross over to the Orinoco basin (see *Bull. Imer. Geogr. Soc.*, Vol. 45, 1913, pp. 664-666, with map). Returning down the Jraricoera Doctor Farabee in October reached Bõa Vista, a station on the upper Rio Branco. Three tribes were visited on this trip, the Porocotos, Ajamares, and Zaparas. 'rom Bõa Vista Doctor Farabee made a side excursion to Mt. Roraima. He then tarted east through the territory of the Macusi Indians on the last and most arduous tretch of the journey. After a brief stay at Dada-nawa (2° 48′ N. and 59½° W.), the eat of the government agent for the Indians of southern British Guiana, Doctor Faraee in November continued eastwards through unknown territory in southern British uiana, crossing the headwater streams of the Essequibo River at right angles and ıaking a wide detour across the frontier into Brazil and back again into British erritory. Depletion of his ammunition supply finally forced him to return to civilizaion by the quickest possible route, which proved to be by way of the Corentyne, the oundary river between Dutch and British Guiana. Georgetown was reached on April 9, 1914. On this trip, from the middle of December to the first of April, the party as among tribes who had never seen white men before. The following tribes were isited: Waiwai, Parikutu, Waiwē, Chikēna, Katawian, Toneyan, Diow, Kumayenas, nd Urukuanas. Some evidently belong to Carib, others to Arawak stock.

After recovering in Barbados from the hardships of this trip Doctor Farabee returned o Para. Leaving here early in July he made the 3,000-mile journey up the Amazon to he upper Ucayali River. Here the following tribes were studied: Conibos, Cashibos, ipibos, Cocamac, and Piros. From these explorations he returned to Para in October, 914.

From the first of November of that year until the middle of February, 1915, Doctor 'arabee was engaged in conducting archeological investigations on the island of Marajó n the estuary of the Amazon. The amphibious nature of the region is indicated by the act that in periods of flood transportation is by canoes drawn by oxen through the all reed grass which still protrudes several feet above the surface of the water.

Early in March, 1915, Doctor Farabee set out again. This journey was devoted to he region between the Tapajoz and Xingú Rivers. Along the lower reaches of the 'apajoz the Maués were visited; along the middle reaches, the Mundurucus, whose entral village in the interior, away from the river, Doctor Farabee was the first to isit. Along the upper reaches of the Tapajoz, leading to the Juruena, the Apiacas ere studied. The region between the Tapajoz and the Xingú was found to be savanna, northward projection into the Amazon equatorial forest of the *campo geral* of southentral Brazil. The occurrence there of the emu, a bird adapted to a grassland environıent, is an indication of this relation.

Route surveys were made wherever the expedition traveled in unknown territory. 'his was especially the case in the British Guiana-Brazil boundary region. A traverse, hecked by astronomical observations, was made of the Corentyne River which corrects ome wide errors in existing maps.

Colonel Fawcett's Explorations. Colonel Fawcett's accounts of his South Amer can explorations are always interesting and often thrilling. Few living explorers hav had the courage to return as he does again and again to the scenes of former hazard In a recent article (Penetrating the South American Jungle, *Travel,* July, 1916) h amplifies a shorter account of his last expedition (see the *Geogr. Journ.,* Vol. 45, 191 pp. 219-228) and gives some most interesting photographs of the savages whose remot realm he entered. It will be remembered that the precise location of the numerous tribe he discovered was not given, in view of the hope that at the close of the war a scientifi expedition might be fitted out to make a thorough study of them. This hope is expresse again, and the account given in his latest paper will go far toward stimulating popula interest in his proposal. A first-class expedition is required, one commensurate i equipment and personnel with the importance of the task of conducting a major piec of exploration among a group of hostile tribes in a great region hitherto unknown.

Pacific Port Development in Colombia. Great opportunities have arisen fo Buenaventura, Colombia's chief port on the Pacific Ocean, since the opening of th Panama Canal and the completion, two years ago, of the railroad connecting it wit Cali in the Cauca Valley. At present the port is practically the sole outlet of the vas cattle lands and coffee plantations of this fertile valley. It has no modern shippin facilities and is unfortunately built on a low, unhealthful site. Since the visit of th yellow fever commission of the Rockefeller Foundation the question of sanitation ha absorbed the attention of the government. The estimated cost of the necessary work in this respect and in that of harbor improvement are so high that the government i considering the alternative plan of moving the port. With this object in view th Colombian Congress has approved the appointment of a commission for the complet survey of Magdalena Bay immediately west of Buenaventura (*Commerce Repts.,* Oct 17 and Nov. 17, 1916.)

EUROPE

The Geographical Basis of the French Spirit. Professor H. J. Fleure of th University College of Wales at Aberystwyth contributes a sound geographical interpreta tion of France to the November, 1916, issue of the *Scottish Geographical Magazin* The features which have produced French unity and have made France a world-cent of civilization have a geographical foundation. Physically France is made up of basi fringing plateaus of old rocks. A happy distribution of the lowlands has provide avenues through which far-spread influences have penetrated the country. Up the sunn corridor of Provence and Burgundy and through the narrow gate of Carcassonne cam the visions of Mediterranean civilization to brighten the cloudier northern basins. Th gates of Metz-Verdun, the Meuse-Sambre, and that of Ypres gather up roads fro Central Europe and from Asia beyond. Then there are the ways of the sea. Th Channel, that passed on Gallic civilization to Britain, gave the northerners an entr to France. The way of the open sea, Brittany, is one of those Celtic lands whose contri butions to the life of Western Europe have been little appreciated as yet.

The meeting point of these roads is the Paris Basin, and there have met and blende the ideas and ideals that have traveled along them. And from the rich interweavin has been created the national spirit, of which the high expression is the Frenchman' ability to keep in sympathetic touch with the ideals and thought of other nations.

Cattle Resources and the War. The problem of the belligerents' supply of mea is the subject of a contribution to the *Annales de Géographie* for March 15, 1916, b Henri Hitier (pp. 81-96). At the beginning of the war about 15,000,000 head of cattl made up the French reserve. It soon became evident, however, that the rapid depletio brought about by war conditions was a serious threat to the very existence of th national supply. Before the war it was possible to slaughter annually some 2,000,00 oxen and export about 100,000 without reducing the total number in the country. A the end of the first year of fighting the national stock had been reduced to 12,300,00 head. To stop further inroads France began importing frozen meat and naturall turned to its colonies for supplies. In Madagascar, where cattle raising has alwa been an important industry, it was found that half a million head could be slaughtere annually without impairing the island's reserves. The attempts to ship live cattle t France having proved too costly, slaughter houses and the necessary plants were provide at Boamanary and Diego Suarez. Other colonies from which France draws for its mea consumption are French West Africa and New Caledonia. The protectorates of Tuni and Morocco have an annual excess of cattle which is of sufficient importance to con stitute a further reserve.

In Great Britain an average of 1,250,000 tons of meat are consumed each year. Of iis only 60 per cent is provided by home products. The first two years of the war ppear to have brought little change in the British meat situation beyond a rise in the onsumption per head on account of the necessity of providing the army with fighting itions. Russia is worse off than either France or England on account of her isolation nd the difficulty of making good the annual deficit of 3,000,000 head brought about by ie war. The country, however, had a large reserve at the beginning of the war from hich she can draw for about ten years.

In considering sources of supply for the Allies' consumption Canada takes the lead ı North America, the United States having become an importing country. In South merica, Argentina, Uruguay, and Brazil can export increasing quantities year by ear. It is now calculated that a minimum of 11,500,000 head of large cattle have to e slaughtered annually for the consumption of all the mobilized belligerents. The ravity of the situation for the isolated Central Powers is apparent. The situation is ll the more serious when it is remembered that each year of the war sees a deterioration ı the quality of the cattle and that ill-nourished beasts yield small meat returns.

Vulcan Enchained: Utilization of Steam for Power in Italy. In central Tuscany ear Volterra volcanic activity appears in the form of numerous *soffioni,* powerful jets f superheated steam issuing from the fissured ground. The steam is impregnated with oron salts and has long been used in the production of borax and boric acid and incientally for warming the houses of the adjacent village. In 1903 the enterprising resident of the borax works attempted to utilize the steam as a source of motive power. By driving bore-holes to a depth of 300 to 500 feet he obtained steam at temperatures rom 150° to 190° C. and under a pressure of two, three, or even more atmospheres. The experiments were continued on an increasing scale until the outbreak of the war, when the scarcity and high price of coal added to the prospective importance of the iew source of power. The inventor promptly extended his installation and now can send ower to Florence, Leghorn, Volterra, and other Tuscan industrial centers. It is proosed to introduce the method in other parts of Italy (*Engin. Suppl. of the London Times,* Nov. 24, 1916).

ASIA

Arabia, a New Sovereign State in Asia. As was foreseen in an article entitled "Europe at Turkey's Door" in the *Review* for April, 1916, the Arabs have declared ınd effected their independence of Turkish sovereignty, as reported to the State Departnent on November 11, 1916, by the Minister of Foreign Affairs of the new state in an ındated telegram from Mecca. The Emir and Sherif of Mecca is the new ruler. His ıuthority is strong in the Hejaz, where the influence of Mecca and Medina, the two ıoly cities of Islam, prevails. According to recent press reports, the Turkish armies elsewhere in the peninsula are being gradually overcome by the Arab insurgents, and it s not unlikely that the movement is the beginning of the complete detachment of Arabia from the Ottoman state.

Arabia became a dependent province exactly four hundred years ago. Turkish rule, ıowever, was never enforced thoroughly. To the Arab, bred in a Mediterranean climate ınd inheritor of Babylonian and Egyptian civilizations, the Turk has always remained the barbarian who came from the cold steppes of Central Asia to destroy his work of civilization. The desert and the inaccessible retreats of the interior plateau strengthened the spirit of independence in the Arab. Much of the success of the Arabian revolution is due to the inability of the Turk to withstand the climate of the peninsula. In vain has the flower of Ottoman manhood, recruited from the valleys of Macedonia or Anatolia, been sent in yearly streams for the last forty years to quell Arabian revolts. Arabian history is a tale of factional strife. Life in the barren stretches of the peninsula s beset with difficulties. Isolated districts became seats of petty principalities. The ıearest approach to unity was supplied by the bond of Islam soon after Mohammed's conquest of Mecca. But the influence of a central government, organized to rule, has ıever been felt in the region. The new state today is bound by strong ties to Great Britain and France. The population, estimated at over 10,000,000, may soon derive from this contact the advantages already obtained by the Egyptians and Algerians.

A Proposed New Water Route to Siberia. The establishment of a sea route between Siberia and Western Europe has been the dream of a long succession of ıavigators. Definite hopes for its realization have followed on the successful voyages ıccomplished by Jonas Lied (see *Bull. Amer. Geogr. Soc.,* Vol. 46, 1914, pp. 134-135, and *Geogr. Journ.,* Vol. 43, 1914, pp. 481-500), whose return from his 1916 trip is an-

nounced by the *Russian Section of the London Times* for December 30, 1916 (see al "Northern Routes of Commerce between Europe and Asia," *Geogr. Rev.*, Vol. 1, 191 p. 144). As Nansen points out in "Through Siberia," we still know very little physical conditions in the Kara Sea, whose ice-blocked waters prove the chief obsta along the route, and the certainty of navigation as a regular economic movement hardly assured. In this connection it may be remarked that valuable data are anti pated from the recently created meteorological station of Port Dickson, at the mou of the Yenisei estuary. Moreover, wireless reports from this station have proved valuable that it is hoped to establish another on White Island, at the western entran to the Gulf of Ob.

Meanwhile a new solution of the navigation problem has been proposed by Nosilov, an experienced Russian traveler and explorer (*Russian Section of the Lond Times*, Nov. 25, 1916). M. Nosilov believes that a route can be established across t Yamal Peninsula, which thrusts forward its mass between the Kara Sea and the Gu of Ob, over ground anciently traversed by the intrepid Novgorodian traders but sin their passing left almost without interruption to the sole occupancy of the nomad Samoyeds. The proposed route will be taken across the base of the peninsula, a degr or more south of the principal navigation line and portage of the Novgorodians. By th means the voyage through the Kara Sea will be obviated, and advantage can be taken the early disappearance of ice from the Kara Gulf. The route will make use of portio of the rivers Saletta and Yuribei flowing into the Ob and Kara Gulfs respectively. T river channels will be deepened where necessary, and across the low, lake-studded wate shed a canal will be cut. Altogether the length of the route is estimated at 130 mile On the Kara Gulf near Cape Morra-sale a good natural harbor has been selected for t ocean port, where will be transhipped freight brought on river boats from the O The concession has already been granted by the government, and the beginning of co struction work is planned for the spring of 1917. If successful, this venture will op up a little known region (see also *Board of Trade Journal*, January 4, 1917, p. 5 which also states that the "Obi-Yenisei Canal" is now under construction). Our chi geographical data on it comes from the reports of the Russian Geographical Society expedition of 1908, of which a résumé and a valuable map by B. M. Shitkow may found in *Petermanns Mitteilungen* for 1911 (Vol. 57, Pt. 2, pp. 11-14, 67-71, and Pl. see also the same author's article on the sea route to Siberia, *Geogr. Zeitschr.*, Vol. 1 1912, pp. 202-213).

Natural Resources of Formosa. Formosa, or—to use the official Japanese name Taiwan, is a rice-growing country, two crops being obtainable annually wherever t water supply is abundant. Under Japanese administration, in effect since 1895, t area under cultivation has been greatly extended and includes the upland as well the lowland variety. In 1915 the production of this staple amounted to 4,784,587 *kok* or 23,731,551 bushels, according to figures given in the "Sixteenth Financial and Ec nomic Annual of Japan" issued by the Department of Finance at Tokyo, 1916 (p 189-191). In the northern districts Oolong and Pouchong teas are the princip products. Although little progress has been made in this branch of production, expo was valued at over 4,000,000 in 1915, a gain due to the high market created by t war. Sugar-cane cultivation has improved during the last decade, a number of mode factories having been built since 1908. The island yield of camphor and tobacco also satisfactory. Camphor is obtained from the *kusu* tree and ranks as the mo important forest product of Formosa. Considerable sections of forested areas still awa exploitation, especially in the regions in which the natives have not been pacifie Northern Formosa is also known for its mineral production, which comprises gol copper, petroleum, sulphur, and phosphorus. The total value of mineral products, le than $150,000 in 1899, reached about $2,500,000 in 1915, and the progress of exploratio indicates this latter figure susceptible of further increase. In the development of th and other industries the active participation of the government is apparent. A partic lar feature of it is the system of monopolies. First granted in respect of opium as restrictive measure, the system has been subsequently applied to the exploitation c salt, camphor, and tobacco and has proved a financial and economic success.

PHYSICAL GEOGRAPHY

Atmospheric Pressure-Change Charts. A paper entitled "On Pressure-Chang Charts," by Edward H. Bowie, in the March, 1916, *Monthly Weather Review* shoul be of considerable interest to geographers, because it shows the kind of geometric complications arising when changes of moving phenomena are charted. Isallobar

ressure-change) charts have been recognized for a long time as important aids in ather forecasting. Even a casual examination of such charts shows that the movent of areas of maximum and minimum change seems to have very little relation the positions of cyclones and anticyclones. This discordance has led to the belief it the pressure change should be regarded as an independent phenomenon. Mr. wie shows that cyclonic systems of the most simple form and movement result in nplicated pressure changes. These simplified ideal cyclones and anticyclones show hat the isallobaric charts are but representations of pressure changes that result ectly from the movements of and changes of pressure level in highs and lows, and thing more. It is obvious, however, that, the nature of these maximum pressure anges being known, many precepts that will materially aid the forecaster may be und.'' Mr. Bowie has pointed out clearly that the isallobaric charts, properly used, ve the forecaster at a glance information which he could only obtain from a careful idy of the isobaric maps at the beginning and end of the interval covered by the illobaric map.

The paper emphasizes the importance of paying particular attention to the necessary ometric consequences of charting moving phenomena. The movements of the areas great and little change are shown to be the inevitable result of the movement and anges of the phenomena for which the change is charted. It is obvious that this inciple is one which has a wide application and that the caution implied in the paper ould be heeded in all investigations dealing with such phenomena, regardless of how ratic the movement of areas of change appears to be when compared with the movements of the areas resulting in the changes. It also furnishes another illustration of e necessity of a careful investigation of the different phenomena to show what relations ist between them and for a thorough consideration as to which is the cause and which the result.

WILLIAM GARDNER REED.

ECONOMIC GEOGRAPHY

Production of Synthetic Nitrate. The production of synthetic nitrate is one of e outstanding problems of industrial preparedness. A part of its significance lies in e unique relation the nitrate products hold in their adaptation to the arts of both ar and peace. A plant using the new cyanamide process can readily convert its production of fertilizer during times of peace to nitric acid and its derivatives in event of ar. The present efforts on the part of the Central Powers show the value of independice of the Chilean sources of supply apart from consideration of the much-debated iestion of exhaustion of the natural deposits. As a national problem the manufacture f a synthetic nitrate is now being studied by a special committee composed of the embers of the National Academy of Sciences and the Naval Consulting Board, and ie sum of $20,000,000 has been appropriated for a nitrate and fertilizer plant. eographically the chief interest of the problem lies in its dependence on a supply of ieap water power. Hence its future in the United States is bound up with the evelopment of hydro-electric resources and is thus related to several pressing questions f control and finance. It may be remembered that the first attempted production of xed nitrogen was made by two Americans at Niagara in 1902, but their venture failed ecause of the high cost of hydro-electric power (L. H. Baekeland: Renewing the arth from the Air, *Scribner's Magazine,* November, 1916).

EDUCATIONAL GEOGRAPHY

Need of Publicity for Geography in Educational Circles. Physical geography oday is faring badly in the secondary schools. It is being displaced in large numbers f high schools each year, and is being almost ignored in many others. The last gures available are for the year 1910, when the percentage of high-school pupils nrolled in physical geography showed a falling off of nearly 50 per cent as compared rith its maximum.

During these years when our subject has been rapidly losing ground as a school ubject, history, which in Europe is often the companion of geography, has been making reat gains. History is now getting three or four years of time in the secondary school ourses, while geography is fortunate to secure one year or even a half year. While ully recognizing the value of history, I cannot believe that six semesters of history re educationally better than four semesters of history and two of geography. I am onfident that if the question were effectively presented to them, school men will grant hat geography is a fundamental branch of study, essential to a broad education, and leserving of a place in the schools.

With respect to geography, the important matter of educating school administrato is being overlooked. Geographical articles in the leading educational magazines are rarity. School principals, superintendents, and normal school presidents seldom see article which starts them to thinking on the subject of geography in education. Th see any number of articles on general science, agriculture, manual training, and co mercial branches: on history, and English, and the languages, but only now and then a voice raised through the educational press in the interests of geography. It must l remembered that the *Journal of Geography* reaches very few of the men who administ our school systems.

The four educational periodicals of scholarly character and wide circulation in th country are the *School Review*, the *Educational Review*, the *Pedagogical Seminary*, ar *Education*. The *School Review* prints nearly 1,000 pages a year. In the last te years—embracing nearly 10,000 pages—it has had one 2½-page geographical artic (on map drawing), but in the first ten volumes it had eight articles, including thr by Professor Davis, two by Professor Tarr, and one by Professor Brigham. Th *Educational Review* has had one geographical article in the last twelve volumes, but ha fourteen articles in the thirty-four preceding volumes. The *Pedagogical Seminary* h published no geographical article in eight years, and only two in the twenty-one years o its existence. Nearly two-thirds of the volumes of *Education* have no article on geogr phy. This magazine has had only thirteen such articles in thirty-five volumes. The U. S Bureau of Education's bibliography of educational papers shows a progressive declin in the number of papers on geography.

This situation seems to need attention; perhaps it ought to be the attention of th Association of American Geographers and the American Geographical Society. Th present is a favorable time to launch a campaign in support of geography as a branc of education. More Americans are today interested in matters geographical and sem geographical than ever before. The public mind is in a favorable attitude, and scho men are always ready to aid a movement that has public support. R. H. Whitbeck.

GEOGRAPHICAL NEWS

Personal

Captain Roald Amundsen, whose visit to this country for the purchase of a aëroplane for his proposed drift expedition across the North Polar basin was noticed i the December *Review* (pp. 473-474), left New York on January 27 on the S. S. *Phila delphia* to return to Norway.

Professor Raoul Blanchard, professor of geography at the University of Grenobl has been appointed visiting professor from France at Harvard University for the secon half of the current academic year. Professor Blanchard is one of that company o pupils of Vidal de la Blache who have been instrumental in bringing the subject o geography to its present high state of development in France. He is best known for h "La Flandre: Étude géographique de la plaine flammande en France, Belgique Hollande," Paris, 1906, an admirable, well-balanced interpretation of the physical an human geography of a natural region. Since his occupancy of the chair of geograph at Grenoble he has devoted his attention to the anthropogeography of the French Alp He is editor of the *Recueil des Travaux de l'Institut de Géographie Alpine*, whic besides contributions from his students, often contains articles from his pen. In hi "Grenoble: Étude de géographie urbaine," Paris, 1911, he has given us a model cit geography.

Dr. Frank N. Chapman of the American Museum of Natural History reported o his recent expedition to South America in a lecture on January 2 before the Linnæa Society of New York entitled "An Ornithological Reconnaissance of South America."

Professor H. J. Cox of the U. S. Weather Bureau personally conducted the member of the Geographic Society of Chicago through the Chicago office of the Weathe Bureau on February 3, showing them the workings of the instruments used in weathe observations and explaining the method employed in forecasting.

Dr. William Curtis Farabee of the University of Pennsylvania Museum, whose lec ture before the American Geographical Society is referred to above, spoke on "Explora tions in the Amazon Valley and in the Unknown Guianas, 1913-1916" before th Geographical Society of Philadelphia on January 19. On this occasion the Society' Elisha Kent Kane Medal was awarded to Doctor Farabee.

MR. HERBERT W. GLEASON, vice-president of the Appalachian Mountain Club, gave a ·ture on February 7 before the Geographical Society of Philadelphia entitled Scenic Alaska.''

DR. CURT C. HOSSEUS has been appointed to the chair of botany and zoölogy in the aculty of Science at the University of Córdoba, Argentina.

PROFESSOR EMMANUEL DE MARTONNE, who has been giving courses at Columbia niversity as visiting French professor for the first half of the current academic year, iled for France on January 27. Among lectures given by Professor de Martonne uring the last weeks of his sojourn was one in French on Rumania before the Alliance rançaise of New York at the Waldorf Astoria Hotel on December 20.

MR. N. C. NELSON read a paper on ''The Southwest Problem'' before the American thnological Society and the section of anthropology and psychology of the New York cademy of Sciences on January 29.

PROFESSOR G. B. ROORBACH of the Wharton School of Finance and Commerce of the niversity of Pennsylvania gave a lecture on ''Venezuela'' before the Geographic ociety of Chicago on February 9.

MR. JOHN G. ROTHERMEL, director of the Wagner Free Institute of Science, Philaelphia, addressed the Geographical Society of that city on the ''Petrified Forest and ainted Desert, Arizona'' on the occasion of the society's first scientific meeting on anuary 26.

HON. ROBERT STERLING YARD of the U. S. Department of the Interior was speaker f the evening at the exercises signaling the establishment of the National Park ervice of the United States Government under the joint auspices of the Department f the Interior, the American Scenic and Historic Preservation Society, and the Amerian Museum of Natural History at the Museum on January 10, 1917. The creation of e National Park Service by act of Congress approved August 25, 1916, to have the upervision, management, and control of the several National Parks and National Ionuments which are now under the jurisdiction of the Department of the Interior, the rkansas Hot Springs Reservation, and such other national parks and reservations of ke character as may hereafter be created by Congress, has long been advocated by arious civic and scientific bodies and marks a notable advance in the movement for e protection and public enjoyment of the scenic, scientific, and historic treasures of he country.

OBITUARY

DR. MAX GROLL, instructor in cartography in the department of geography of the Jniversity of Berlin and in the Oceanographical Institute of that city, died on November , 1916, in his forty-first year. Doctor Groll is best known by his admirable bathyetrical charts of the oceans (Tiefenkarten der Ozeane, *Veröffentl. des Inst. für Meereskunde, Neue Folge, A: Geogr.-naturwiss. Reihe,* Heft 2, Berlin, 1912) which were eviewed in the March, 1916, number of the *Review* (p. 213). These maps are models f geographic representation. Doctor Groll was also the author of an excellent small anual on cartography (Kartenkunde: I, Die Projektionen; II, Der Karteninhalt, 2 ols., Leipzig, 1912; reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, p. 542).

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

General

TYRRELL, J. B., edit. **David Thompson's narrative of his explorations in weste America, 1784-1812.** lxiv and 582 pp.; maps, ills., index, bibliogr. The Champl Society, Toronto, 1916. 10 x 7.

This narrative is an entertaining account of Thompson's travels, written by natural story teller. His observations, covering a wide range of subjects, appear have been systematic rather than haphazard, and to all Thompson gave the fullest co templation. Naturally from a fur trader should come notes on the habits of anima and such as Thompson gives are more than superficial jottings. Then again, Thomps spent much time among the Indians of the Northwest, and his ability to deal symp thetically with the various tribes not only enhanced his value as a fur-trader but a allowed him to learn and understand to a high degree their theory of life; thus maki his accounts of the many tribes particularly trustworthy and valuable. To list the ite which attracted the eyes and mind of Thompson would take much space; so many a they, so carefully does he record them, and so much did he do in opening the gre Northwest that the reader, as he ends the final chapter and studies the maps, will agr with the editor that the life and work of such a man should not be allowed to lie obscurity, but that some tribute should be made "as a token of respect for the man a his work."

Thompson traveled more than 50,000 miles in this time as a trader, and in additi to the immediate duty of seeking pelts he surveyed the entire area of his travels a checked much of his work by later surveys. Of his work as a surveyor, topographer, a geographer, the editor of this narrative, J. B. Tyrrell, a geologist familiar with t region of Thompson's labors, has the highest regard. To the strict test of surve and observations on the ground Tyrrell subjected the work of Thompson and found t work "of the very highest order," and he at the same time formed so great "admiration for this fur-trading geographer" that he has edited this volume as monument to Thompson. R. M. BROWN.

WOOD, R. K. **The tourist's Northwest.** xiv and 528 pp.; maps, ills., index. Dod Mead & Co., New York, 1916. 8 x 5.

The author's intentions have to be judged by the contents, as this volume is witho an introduction. The Northwest as here presented includes the American Northwest Oregon and Washington and also the Canadian Northwest of Alberta and British Colu bia. Considerable space is devoted to hotels, railroads, and local itineraries. The auth has collected the essential things that are of value for the tourist to these region Crater Lake, the Columbia River, and Mt. Rainier are given popular description accompanied by accurate information regarding rates and routes. In Canada the chi points are Glacier, Banff, Lake Louise, and Victoria. Some of the descriptions are we done and others are highly enthusiastic. The handbook contains an immense amou of information gained from chamber of commerce reports and popular publications. this book is intended for the tourist on the road, its heavy covers, thick paper, and si make it a clumsy volume. It would have been better to make two volumes for the sam material, finer type, smaller page, good local maps, and limp covers. The five maps a excelled by those generally furnished gratis by the railroads.

However, the tourist to the Northwest will find this handbook of value to use alon with the latest Baedeker and especially the guide books issued by the respective gover ments. W. M. GREGORY.

—— **American Indian, A museum of the.** *The Outlook*, Vol. 114, 1916, Oct. 1 No. 6, p. 301. [Refers to the museum described in the December *Review*, pp. 407-418.]

ANDREWS, C. L. **Marine disasters of the Alaska route.** *Washington Hist. Quart* Vol. 7, 1916, No. 1, pp. 21-37. [The thousand-mile-long channel from Seattle to Skag way, Alaska.]

BLINK, H. **De scheepvaart- en scheepsbouwvraagstukken in Noord-Amerika** Diagr. *Tijdschr. voor Econ. Geogr.*, Vol. 7, 1916, No. 3, pp. 89-99.

Burton, C. M., and M. A. Burton, edits. **The journal of J[ohn] L[ees], of** **uebec, merchant.** 55 pp.; maps, index. Soc. of Colonial Wars of the State of chigan, Detroit, 1911. $2.00. 9½ x 6. [Date: April to October, 1768; route: Lon- n, Boston, New York, Albany, Buffalo, Detroit, down Lakes Ontario and Erie and the Lawrence to Montreal.]

Campbell, J. V. **The Sinclair party: An emigration overland along the old** **udson Bay Company route from Manitoba to the Spokane country in 1854.** *Wash-* *gton Hist. Quart.*, Vol. 7, 1916, No. 3, pp. 187-201. [''This article was collated and epared by Mr. William S. Lewis, from a series of letters written to him by Mr. John Campbell of Lillooet, British Columbia.'']

Da Vella, —. **La produzione del petrolio nel Nord-America in rapporto colla** **oduzione mondiale petrolifera.** 13 pp. [*Boll.*] *Direz. Gen. degli Affari Commerc.*, 15, No. 15. Minist. degli Affari Esteri, Rome.

Frothingham, E. H. **The northern hardwood forest: Its composition, growth,** **d management.** 79 pp.; map, ills. *U. S. Dept. of Agric. Bull. No. 285.* Wash- gton, D. C., 1915. [For abstract, see the April, 1916, *Review* (Vol. I, p. 298).]

Griffin, G. G., comp. **Writings on American history, 1913: A bibliography of** **oks and articles on United States and Canadian history published during the** **ar 1913, and some memoranda on other portions of America.** xvii and 193 pp.; lex. Yale University Press, New Haven, 1915. $2.00. 10 x 7. [''Eighth number a continuous series opening with 1906.'']

Headlam, Cecil. **America and West Indies, 1704-1705: Calendar of state** **pers, colonial series.** xl and 807 pp.; index. The Hereford Times, Ltd., London, 16. 15s. 10½ x 7½.

Molbech, O. C. **Pelsvaerkshandelen i Nordamerika.** *Geografisk Tidskrift*, Vol. , 1915-16, No. 5, pp. 179-188. Copenhagen.

Nickles, J. M. **Bibliography of North American geology for 1915, with sub-** **ct index.** 144 pp. *U. S. Geol. Survey Bull. 645.* Washington, D. C., 1916.

Canada

Yukon, Northwest Territories, British Columbia

llison, W. H. **In the wake of the war canoe: A stirring record of forty years' successful labor, peril, and adventure amongst the savage Indian tribes of the Pacific Coast and the piratical head-hunting Haidas of the Queen Charlotte Islands, B. C.** 352 pp.; map, ills., index. E. P. Dutton & Co., New York, 1916. 8 x 5.

The subtitle of this volume connotes a sensationalism which is entirely foreign to its ntents, for it is indeed the simple narrative of the life of a pioneer missionary on the itish Columbia coast. Into this have been woven many facts of ethnologic and his- ric interest. It is to be wished that Mr. Collison had made his record of fact relating the primitive customs and mode of life of the Haidas more complete, for he was the st scholar to become intimately acquainted with these people.

The volume deals specifically with the Tsimshians of the Nass and Skeena River gion, and with the Haidas of the Queen Charlotte Islands. An all too brief chapter devoted to the Tsetsant (spelled Zitz-Zaow by the author) Indians. This tribe, now actically extinct, previously occupied Portland Canal and is a foreign element on the ast, for it belongs to the Athapascan stock of the interior.

In addition to containing much valuable ethnologic data, the volume also includes me important historical matter relating to the missions and the early settlements along e northwest coast of British Columbia. It is above all a valuable record of the condi- ons of travel and life during an epoch which has now passed, and presents a vivid cture of the conditions which confronted the pioneer missionary. The book contains any good halftones, chiefly illustrating Indian life. One of these shows a well-built uss bridge which, though evidently the work of white men, is credited to Indian craft. he map which accompanies the volume has nothing to recommend it. It is poorly awn, badly reproduced, and so full of glaring errors as to disfigure a book that in her respects has been printed in very attractive form. A. H. Brooks.

oper, W. S. **Plant successions in the Mount Robson region, British Columbia.** *Plant World*, Vol. 19, 1916, pp. 211-238.

Mount Robson is situated in the Canadian Rockies near the eastern boundary of itish Columbia. It lies in a region which, so far as ecological study is concerned,

is unknown. The forests here are transitional between those of the Pacific Coast a those of the Rocky Mountains. Two forest zones are distinguished: the montane zo extending up to 3,250 feet, and the sub-alpine zone, extending from 3,250 feet up timber line at 6,500 feet. The climax forest in the montane zone, made up of *Th plicata, Picea Engelmannii, Tsuga heterophylla, Pseudotsuga mucronata,* and *Al lasiocarpa,* is of the Pacific Coast type. The climax forest of the sub-alpine zone, c sisting of *Picea Engelmannii* (dominant), *Abies lasiocarpa,* and *Pinus albicaulis,* a differing from that of the montane zone in the smaller number of species and in smaller size of the trees, belongs rather to the Rocky Mountain region. The success of plant associations on talus moraines and shingle flats is described in some det Successions in the two zones are much alike, and all of them lead to the establishm of a climax forest. Some interesting correlations are pointed out between the ages trees growing on the successive terminal moraines of the retreating Robson Glacier a the rate of retreat. GEORGE E. NICHOLS

SHAW, C. H. **The vegetation of the Selkirks.** Map. *Botanical Gazette,* Vol. 1916, No. 6, pp. 477-494.

Doctor Shaw, who was drowned in 1910, left a collection of notes from which t paper has been compiled.

The region of the Selkirks is entirely forest-clad up to the timber line, at an aver elevation of 6,200 feet. Below 4,600 feet the forest may be classed as montane. is broadly distinguished into eastern and western divisions by the greater luxuria of the latter. The montane forest passes upwards into a sub-alpine formation, whi in turn, interlocks with alpine meadows. The limit between trees and grass is mai governed by topography and exposure. Where sheltered depressions collect heavy, lo enduring snows, tree growth is suffocated and the tree line dips downwards. Snow a low temperatures control the upper limit of the meadows, but rock avalanches a constitute an ecological factor determining the occurrence of desert.

CAIRNES, D. D. **Mayo area; Scroggie, Barker, Thistle, and Kirkman Cree Wheaton District, Yukon Territory.** Maps, bibliogr. *Summary Rept. Geol. Sur of Canada for 1915,* pp. 10-49. Ottawa, 1916.

CAMSELL, CHARLES. **An exploration of the Tazin and Taltson Rivers, No West Territories.** 124 pp.; map, ills., index. *Geol. Survey of Canada Memoir Geol. Series No. 69.* Ottawa, 1916. [Abstracted in the October *Review,* p. 302.]

CAMSELL, CHARLES. **Exploration in the northern interior of British Columb** Map, bibliogr. *Summary Rept. Geol. Survey of Canada for 1915,* pp. 70-75. Otta 1916.

COLEMAN, A. P. **Glaciers of the Rockies and Selkirks.** 29 pp.; ills. Domin Parks Branch, Dept. of the Interior, Ottawa, [1916?].

DAWSON, W. B. **Tide tables for the Pacific coast of Canada for the year 19 including Fuca Strait, the Strait of Georgia, and the northern coast. With d for slack water in the navigable passes and narrows and information of currer** 64 pp. Tidal and Current Survey, Dept. Naval Service of the Dominion of Cana Ottawa, 1916.

DRYSDALE, C. W. **Bridge River map-area, Lillooet mining division; the Hig land Valley copper camp, Ashcroft mining division; human skeleton from bed near Savona, British Columbia.** Maps, diagrs., bibliogr. *Summary Rept. G Survey of Canada for 1915,* pp. 75-92. Ottawa, 1916.

DRYSDALE, C. W. **Geology and ore deposits of Rossland, British Columb** xviii and 317 pp.; maps, diagrs., ills., index, bibliogr. *Geol. Survey of Canada Mem 77: Geol. Series No. 64.* Ottawa, 1915.

MACKENZIE, J. D. **Telkwa valley and vicinity, British Columbia.** Maps, biblic *Summary Rept. Geol. Survey of Canada for 1915,* pp. 62-69. Ottawa, 1916.

—— **Nakimu caves, The, Glacier Dominion Park, B. C.** 29 pp.; map, i Dominion Parks Branch, Dept. of the Interior, Ottawa, 1914.

—— **Railway tunnel in America, The longest: The Roger's Pass bore throu the Selkirk Mountains in British Columbia.** Map, diagr., ills. *Sci. Amer. Sup* No. 2096, Vol. 81, 1916, Mar. 4, pp. 152-153.

SAPIR, E. **The social organization of the west coast tribes.** *Trans. Royal S of Canada,* Ser. 3, Vol. 9, 1915, pp. 355-374.

SCHOFIELD, S. J. **Geology of Cranbrook map-area, British Columbia.** vii a 245 pp.; maps, diagrs., ills., index, bibliogr. *Geol. Survey of Canada Memoir 76: G*

ries *No. 62.* Ottawa, 1915. [With a chapter on the regional physiography (Purcell inge) and a geological map, 1:126,720.]

—— **White River district, Upper Yukon Territory.** 1:250,000. Geological Survey of Cana. Map 122A. [Ottawa], 1915.

United States

General

ereness, N. D., edit. **Travels in the American colonies.** 693 pp.; index. The Macmillan Co., New York, 1916. $3.00. 9 x 5½.

This book is a transcription of eighteen manuscripts which contain the records of vers journeys and missions in the American colonies between the years 1690 and 1783. 1e editing of the travels has been done carefully; each manuscript is introduced by a icf statement which gives as far as it is known the purpose of the journey, the politi1 situation along the route, and pertinent extracts from the life of the participant. A ide range of subjects is treated in the volume, and a more personal touch with the nditions under which the colonists lived is vouchsafed the reader than can be obtained om an interpretation by an historian. Among the manuscripts there may be found a urney from Virginia to New England in 1690 on a political mission, an account of a ar's captivity among the Cherokee Indians, missions to the Creeks and the Choctaws, e migration of the Moravians from Pennsylvania to North Carolina, a visit from New ork to Philadelphia during the troublous days of 1778, and the travels of a bishop and is party to fulfill their duties. This group of travelers, not unlike modern explorers, ow a wide variation in the kinds of material noted as of value. In a number of inances, as particularly in Cuthbert Potter's journal, when the traveler was not directly ncerned with his mission, the notes deteriorate to a mere mention of the stages of the urney, while in others, the journal of Diron D'Artaguiette of Louisiana for example, e reader gains an insight into the stage of culture, the climate, and the vegetation, as ell as into the political status of the land. R. M. Brown.

Putnam, G. R. **The Lighthouse Service and its relation to the United States Coast and Geodetic Survey.** *Science,* May 12, 1916, p. 670. [Abstract of an address t the centennial exercises of the U. S. Coast and Geodetic Survey.]

Roman, C. V. **American civilization and the negro.** xii and 434 pp.; ills., lossary, index. F. A. Davis Co., Philadelphia, 1916. $2.50. 9½ x 6. [For extended eview, see article "Our Immigrant Problem," by Ellsworth Huntington in the Decemer, 1916, *Review,* pp. 458-463.]

Ross, E. A. **The Old World in the New: The significance of past and present mmigration to the American people.** viii and 327 pp.; maps, diagrs., ills., index. The Century Co., New York, 1914. $2.40. 8½ x 6. [For extended review, see article 'Our Immigrant Problem," by Ellsworth Huntington in the December, 1916, *Review,* p. 458-463.]

Schoff, W. H., edit. **[Report of proceedings of] Eighth annual convention of he Atlantic Deeper Waterways Association held at Savannah, Georgia, November), 10, 11, and 12, 1915, with preliminary sessions at Richmond, Va., Raleigh, N. C., and Columbia, S. C., November 7 and 8, 1915.** 311 pp.; maps, ills. Atlantic Deeper Waterways Association, Philadelphia, 1916.

Schuchart, T. **Der Aussenhandel der Vereinigten Staaten von Amerika: Eine statistische Studie.** 34 pp.; diagrs. *Meereskunde: Sammlung volkstümlicher Vorträge,* Vol. 9, 1915, No. 11. Berlin.

Smith, G. O. **The United States Geological Survey and its relation to the United States Coast and Geodetic Survey.** *Science,* May 12, 1916, pp. 659-665. [Address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

Smith, H. M. **The Bureau of Fisheries and its relation to the United States Coast and Geodetic Survey.** *Science,* May 12, 1916, pp. 665-666. [Abstract of an address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

—— **State supplements to Frye's Primary Geography: (1) The New England States.** By J. S. Vaughn. 8 pp. [1915]. (2) **Middle Atlantic States.** 18 pp. [1915]. (3) **Washington and the District of Columbia.** By Ella Given. 6 pp. (4) **Central States (Eastern Section).** 8 pp. [1915]. (5) **State of Washington.** 8 pp. [1915]. Ginn & Co., Boston. 10 x 8.

—— **State supplement to Frye's Home Geography: (1) New Jersey.** 10 pp. 1912. (2) **Pennsylvania.** 14 pp. 1912. (3) **Washington.** 9 pp. 1912. Maps, ills. in each. Ginn & Co., Boston. 8 x 6 each.

—— **State supplements to Frye's Higher Geography: (1) Delaware.** By E. Cross. 12 pp. 1915. (2) **Mississippi.** By J. N. Poers. 16 pp. 1915. (3) **Ne Jersey.** By Ella Huntting. 15 pp. 1914. (4) **South Carolina.** By Frank Eva 12 pp. 1906, 1912. Maps, ills. in each. Ginn & Co., Boston. 12 x 10 each.

—— **State supplements to Maury's New Geographies: (1) Texas.** By R. Hill. 18 pp. 1908, 1912. (2) **Virginia.** By W J McGee. 18 pp. 1908. Ma diagrs., ills. in each. American Book Co., New York. 12 x 10 each.

—— **State supplements to Redway and Hinman's Natural Geographies:** (**Alabama.** By J. L. M. Curry. pp. 1-6. 1898, 1913. **Mississippi.** By J. L. M. Curr pp. 7-12. 1898, 1913. **Louisiana.** By W. W. Clendenin. pp. 13-17. 1898, 191 **Arkansas.** By A. H. Purdue. pp. 18-22. 1898, 1913. (2) **California.** 12 pp. 189 (3) **Colorado.** 13 pp. 1914. (4) **Florida.** By W. F. Yocum. 12 pp. 1910, 191 (5) **Georgia.** By D. Q. Abbott. 7 pp. 1898. (6) **Idaho.** 12 pp. 1907, 1914. (**Illinois.** 12 pp. 1908, 1913. (8) **Indiana.** By C. R. Dryer. 12 pp. 1909. (9) **Iow** By George Chandler. 9 pp. 1898, 1907, 1912. (10) **Kentucky.** 10 pp. 1909, 191 (11) **Maine.** By W. W. Stetson. pp. 1-7. 1898, 1913. **New Hampshire.** By L. Rundlett. pp. 8-13. 1898, 1913. **Vermont.** pp. 14-17. 1898, 1913. **Massachusett** By J. C. Lyford. pp. 18-26. 1898, 1913. **Connecticut.** pp. 27-34. 1898, 191 **Rhode Island.** pp. 35-38. 1898, 1913. (12) **Maryland.** By C. L. Garrison. pp. 1- 1898, 1913. **Delaware.** By C. L. Garrison. pp. 8-9. 1898, 1913. **District of Colum bia.** By C. L. Garrison. pp. 10-14. 1898, 1913. (13) **Michigan.** By L. H. Woo 16 pp. 1910, 1914. (14) **Minnesota.** By C. W. G. Hyde. 10 pp. 1898, 1914. (15 **Missouri.** By J. A. Merrill. 10 pp. 1898, 1907, 1912. (16) **Montana.** 20 pp. 191 (17) **Nebraska.** By C. G. Pearse. 10 pp. 1898, 1908, 1913. (18) **Nevada.** 6 p 1907. (19) **New Mexico.** By C. M. Light. 12 pp. 1912. (20) **New York.** 27 p 1912, revised to 1915. (21) **North Carolina.** By Collier Cobb. pp. 1-8. 1898, 191 **South Carolina.** By L. C. Glenn. pp. 9-14. 1898, 1913. (22) **North Dakota.** B L. L. Perrine. 12 pp. 1912, revised 1915. (23) **Ohio.** By W. M. Gregory. 20 p 1914. (24) **Oklahoma.** 10 pp. 1908, 1912. (25) **Oregon.** 10 pp. 1907. (26 **Pennsylvania.** By M. G. Brumbaugh. pp. 1-10. 1898, 1913. **New Jersey.** By V. Davey. pp. 11-16. 1898, 1913. (27) **South Dakota.** By Doane Robinson. 12 p 1912, revised 1915. (28) **Tennessee.** By J. M. Safford. 8 pp. 1898, 1909, 191 (29) **Utah.** By J. H. Paul. 20 pp. 1908, 1912. (30) **Washington.** By Solon Shed 16 pp. 1910, 1912. (31) **West Virginia.** By R. A. Armstrong. 16 pp. 1912, revise to 1915. (32) **Wisconsin.** By R. G. Thwaites. 8 pp. 1898, 1911. (33) **Wyomin** 11 pp. 1914. Maps, diagrs., ills. in each. American Book Co., New York. 12 x 10 eac

Stratton, S. W. **The Bureau of Standards and its relation to the Unite States Coast and Geodetic Survey.** *Science,* May 12, 1916, p. 667. [Abstract of a address at the centennial exercises of the U. S. Coast and Geodetic Survey.]

Tittmann, O. H. **The international work of the United States Coast an Geodetic Survey.** *Science,* May 12, 1916, p. 672. [Abstract of an address at th centennial exercises of the U. S. Coast and Geodetic Survey.]

—— **United States, Statistical abstract of the, 1915.** 749 pp.; index. Bur. o Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C., 1916.

—— **United States Coast and Geodetic Survey, The one-hundredth anniver sary of the.** *Science,* May 12, 1916, pp. 655-674. [The papers and abstracts constitu ing this article are listed individually.]

Wainwright, Richard. **The Civil War record of the United States Coast an Geodetic Survey, and what the Survey is doing towards preparedness.** *Scienc* May 12, 1916, pp. 671-672. [Abstract of an address at the centennial exercises of th U. S. Coast and Geodetic Survey.]

Yard, R. S. **Glimpses of our national parks.** 37 pp.; map. Dept. of the Inte rior, Washington, 1915. [See also "Personal" item in this number, p. 155.]

North Atlantic States

McAdie, Alexander. **The winds of Boston and vicinity.** Diagrs. *Annals Astron Observ. Harvard College,* Vol. 73, 1916, Part 3, pp. 211-231. Cambridge, Mass.

Professor McAdie's discussion of the winds of Boston and its vicinity forms part o the "Observations and Investigations made at the Blue Hill Meteorological Observator in the Year 1915." This observatory is remarkably well located for the study of jus such subjects as that here investigated. Blue Hill, while not high (640 feet, 195 meters) has a very free exposure; its records have now been kept for a period of over thirt years, practically without change in methods or exposure, and the highest standard o

curacy has been maintained from the beginning. We have, in the present monograph, very complete discussion of the winds at Blue Hill, not only as to the ordinary details direction and velocity, but also as to the correlations between the winds and other eather conditions.

The drift of the surface currents, also of those at higher levels, is from a point ghtly north of west. Wind roses show the percentages of frequency of the different nd directions seasonally and for the year. In general, months of excessive rainfall e months in which the northeast wind has a maximum duration. Dry periods are aracterized by an excess of west wind. It is clearly pointed out that our Atlantic aboard is as dry as it is because the prevailing winds blow from the land. ''If it ere possible to reverse the surface circulation and substitute for the west wind the st wind, the total rainfall would be 50 per cent greater and the number of rainy days ceed 250 instead of the present number, 106.'' This is an interesting statement. Prossor McAdie introduces a new term (p. 220) when he uses *equivents* (cf. *equipluves*) r the departure of the monthly wind velocities from the norm. The relation of wind rection and temperature is strikingly illustrated by means of two figures, which are productions of the instrumental records. The sea breeze at Blue Hill is easily disnguishable from the cyclonic northeast wind (''sea-turn''). The latter has a greater epth and gives a more uniform decrease of temperature. It is noteworthy that a violent understorm does not cool the air as effectively as does the sea-breeze (Fig. 17). Varis other relations of winds are considered, e. g. winds and cloudiness, winds and presre, variation of velocity with elevation, frequency of winds of constant velocities, etc.

Professor McAdie seems to us to have succeeded admirably in condensing a very large mount of information into a very small compass, with a commendable omission of the stomary ''dry'' tabulations, and with an excellent series of carefully selected, clear, nd interesting illustrations. R. DeC. Ward.

EUROPE

Switzerland or the Alps

ucerna, Roman. **Morphologie der Montblancgruppe.** 187 pp.; map, diagrs., ills. *Ergänzungsheft zu Petermanns Mitt. Nr. 181.* Justus Perthes, Gotha, 1914.

The verbal description of mountain forms is one of the most difficult problems in eography. In illustration of progress toward its solution, a comparison may be made etween the description of the Mt. Blanc group by the eminent French architect Viollete-Duc (1877) and the present monograph, for the later work gives the most advanced nd detailed statement of the thesis, already supported by Hess and others as regards rough-valleys, that the work of successive epochs and stages of decreasing glaciation is ecognizable in a corresponding succession of cirques and troughs, of which the smaller nd deeper ones of later excavation are ''nested'' in the larger and shallower ones of arlier excavation: the sharpened ridges between the cirques are thus correlated with he terminal moraines at the lower ends of the troughs. It would be hazardous to express n opinion on the correctness of this interpretation without reviewing the facts on the round, but it is safe to say that Lucerna's study appears to be based on abundant and areful local observation and that his conclusions are well worked out. American alpinists night, it would seem, add a zest to their adventurous explorations by attempting the pplication of Lucerna's thesis in the strongly glaciated mountain groups of the Canalian ranges, and thus at least supplement if not replace their personal narratives with bjective mountain analysis. W. M. Davis.

Beaufoy, Mark. **Narrative of a journey from the village of Chamouni, in Switzerland, to the summit of Mount Blanc, undertaken on the 8th of August, 1787.** Ills. *Alpine Journ.*, Vol. 29, 1915, No. 210, pp. 323-333. [From the original manuscripts in the archives of the Royal Society, which remained unprinted until 1817. With a note, pp. 331-333, by Douglas W. Freshfield.]

Bernhard, Hans. **Veränderungen in der Bodenkultur des Kantons Zürich.** Maps, diagr. *14. u. 15. Jahresbericht der Geogr.-Ethnogr. Gesell. in Zürich (1913-14 und 1914-15)*, pp. 3-28.

Ghezzi, C. **Die Abflussverhältnisse des Rheins in Basel.** 137 pp.; maps, diagrs., ills. *Mitt. der Abteilung für Wasserwirtschaft Nr. 8.* Dept. des Innern, Bern, 1915.

Girardin, M. **Les bassins fermés des Alpes suisses.** *Bull. Soc. Fribourgeoise des Sci. Nat.*, 1913-14, Vol. 22, 1914, p. 15.

Gockel, A. **Das Wetter in Freiburg im Jahre 1914.** *Bull. Soc. Fribourgeoise des Sci. Nat.*, 1913-14, Vol. 22, 1914, pp. 59-65.

Knapp, C. **A propos des premiers cartographes neuchâtelois, Josué Perret Gentil, le Père C. Bonjour, David-François de Merveilleux.** *Bull. de la Soc Neuchateloise de Géogr.*, Vol. 24, 1915, pp. 24-41.

Montagnier, H. F. **A further contribution to the bibliography of Mont Blanc 1786-1853.** Ills. *Alpine Journ.*, Vol. 30, 1916, No. 212, pp. 114-138. [Supplementar to the list contained in the *Alpine Journ.*, Vol. 25, 1911, pp. 608-640.]

Montagnier, H. F. **Articles on the first ascent of the Jungfrau.** *Alpine Journ* No. 210, Vol. 29, 1915, pp. 333-336.

Näf, J. **Graphische Darstellungen der Schweizerischen hydrometrische Beobachtungen im Jahr 1913.** 27 plates and 14 pp. of text. *Veröffentl. der Abteilun für Wasserwirtschaft* [no number]. Dept. des Innern, Bern, 1915.

Nussbaum, F. **Heimatkunde von Bern und Umgebung: Orographie und Geologie.** 24 pp.; maps, diagrs. Stämpfli & Cie., Bern, 1916.

Ott, Adolf. **Die Siedelungs-Verhältnisse beider Appenzell.** Maps, ills bibliogr. *14. u. 15. Jahresbericht der Geogr.-Ethnogr. Gesell. in Zürich (1913-14 un 1914-15)*, pp. 35-62 + 45 pp.

Rothey, L. **La géographie humaine dans le Jura bernois.** *Bull. Soc. Fribourgeoise des Sci. Nat.*, 1913-14, Vol. 22, 1914, pp. 32-35.

Balkan States, including Rumania

Forbes, Nevill, A. J. Toynbee, D. Mitrany, and D. G. Hogarth. **The Balkans: a history of Bulgaria, Serbia, Greece, Rumania, Turkey.** 407 pp.; maps, inde: The Clarendon Press, Oxford, 1915. 8 x 5½.

Four authors have co-operated to present within four hundred pages the histories c five different nations. Forbes tells the story of both Bulgaria and Serbia, while Toynbe writes of Greece, Mitrany of Rumania, and Hogarth of Turkey. Each author worke independently, without opportunity of conferring with his collaborators, a circumstan which explains some lack of unity in style, and a certain amount of repetition in t several sections of the book. The chief merit of the volume is that it gives to the read a valuable, up-to-date résumé of the historical background against which the tragic even of the present must be projected if an intelligent appreciation of Balkan problems is t be secured. For this purpose it may seem that the ancient history of several of t nations might profitably have been still further abbreviated.

The book is a history, not a geography of the Balkan peninsula; but the geograph will find within its pages the records of events clearly reflecting the profound influen of physical environment upon the progress of man's development in this highly interes ing section of the world. Often, indeed, the connection between physical cause an political effect is explicitly stated. The rôle of parallel folded mountains bordering t Adriatic shore as an obstacle to any extension of Serbian power to the seacoast; t effect of the mountainous interior in preventing the complete subjugation of Serbia l Turkey, and in insuring to Montenegro a still greater freedom from Turkish dominatio the importance of the Save-Danube channel as a military obstacle and a political fronti and of the Morava-Maritza and Morava-Vardar trenches as guiding lines for Slavon and other migrations: these and other distinctly geographic problems are repeated brought to the reader's attention, though seldom discussed at any length.

Douglas W. Johnson.

Krusch, [Paul]. **Die nutzbaren Lagerstätten der Türkei und Bulgariens un ihre Bedeutung für die Zentralmächte.** Maps. *Berliner Tageblatt: Wochenausgab* No. 52, Vol. 4, 1915, pp. 14-16. [Abstracted under the title "Bulgarian and Turki Mineral Resources" in the June, 1916, *Review* (Vol. 1, pp. 459-460).]

Martel, E. A. **L'Albanie.** Ills. *La Nature*, No. 2209, 1916, Jan. 29, pp. 65-70.

Pittard, Eugène. **Les peuples de la péninsule des Balkans: Esquisse anthropologique.** *Rev. Gén. des Sci.*, Vol. 26, 1915, No. 23, pp. 665-675.

Italy

Anfossi, G. **Volumetria della Sardegna (Studi orometrici, II).** Maps, diagr *Memorie Geogr.* (Suppl. to *Riv. Geogr. Italiana*) *No. 28* (=Vol. 9, pp. 183-234 Florence, 1915.

Sardinia has a volume (above sea-level) of 8,206 cubic kilometers, a mean height 344 meters, with an area of 23,833 square kilometers. To ascertain the first two fac the author divides his island into 23 regions, the plain of the Campidano, and hill ar mountain masses that are more or less separated from their neighbors by distinct valley

ennargentu, near the middle of the island, is the largest and culminates at 1,834 meters. he area of each district was measured with an Amsler planimeter for each 200-meter ontour of the 1:100,000 map, and from these measures the areas ascertained for each elt between contours. By Simpson's formula, if these areas are called a_0. a_1. a_2. . . . a_{n-1}, a_n, and H be the vertical distance between contours, the volume, V, will be $= \frac{H}{3} (a_0 + 4a_1 + 2a_2 + 4a_3 + 2a_4 \ . \ . \ . \ + 2a_{n-1} + a_n)$ supposing there be an even number of reas. If there be an odd one its volume must be computed as that of a pyramid and dded on.

Graphs have been computed for the slope of each district, taking areas at each 200-ieter contour as abscissas and the elevations corresponding as ordinates. In another et of graphs the abscissas are the radii of the circles with the same area as the figure ontained by the corresponding contour. Then profiles were platted of the boundary f each district and the mean elevation of the *base* of the district thus ascertained. Then he middle of each district was marked with its mean altitude, and, by distributing the ther 100-meter elevations equally between these points and the nearest points of the oast, arbitrary contours of mean elevation are constructed.

Such are the processes that make up an orometric study. MARK JEFFERSON.

ACCOMAZZO, PERICLE. **Il Lago di Candia nel Canavese: Osservazioni fisiche e atometriche.** Diagrs., ills. *Boll. della Reale Soc. Geogr. Italiana,* Vol. 5, 1916, No. 7, pp. 575-605. Rome.

ALMAGIÀ, ROBERTO. **La cartografia del Lazio nel cinquecento.** *Riv. Geogr. Italiana,* Vol. 23, 1916, No. 1, pp. 25-44. Florence. [On maps of Latium of the fifteenth entury.]

BELL, R. H. **Taormina.** xxiv and 172 pp.; ills. Hinds, Noble & Eldredge, New York, [1916]. 8 x 5. [A charming account of a quiet Sicilian town with glimpses at ts environment and its history.]

BRIGG, J. J. **Through the Maritime Alps.** Ills. *Alpine Journ.,* No. 210, Vol. 29, 1915, pp. 300-311.

BRUNO, A. **Il transito attraverso i porti italiani del commercio con l'Africa.** *L'Africa Italiana,* Vol. 34, 1915, No. 8, pp. 206-216; No. 9, pp. 291-295. Naples.

CALIMANI, FELICE. **I profughi di guerra italiani rimpatriati attraverso alla Svizzera.** Maps, ills. *Boll. della Emigrazione,* Vol. 15, 1916, No. 3, pp. 5-35. R. Commiss. della Emigr., Rome.

—— **Emigrazione italiana transoceanica negli anni 1914 e 1915, Notizie statistiche riassuntive sulla, e operazioni relative di vigilanza e di tutela del Commissariato della Emigrazione.** *Boll. della Emigrazione,* Vol. 15, 1916, No. 2, pp. 3-51. R. Commiss. della Emigr., Rome.

FIORE, OTTO DE. **I fenomeni avvenuti a Volcano (Isole Eolie) dal 1890 al 1913.** Diagr., bibliogr. *Zeitschr. für Vulkanologie,* Vol. 1, 1914, No. 2, pp. 57-73; Vol. 2, 1915, No. 1-2, pp. 12-66.

HESS, ADOLFO, AND M. C. SANTI. **La Torre di Lavina m. 3308 (Gruppo del Gran Paradiso).** Ills., bibliogr. *Riv. Mensile Club Alpino Italiano,* Vol. 35, 1916, No. 1, pp. 14-21.

HUTTON, EDWARD. **Naples and southern Italy.** xi and 312 pp.; ills., index. The Macmillan Co., New York, 1915. $2. 7½ x 5. [A book of more than ordinary charm. It subordinates present-day descriptions. Side lights from history, the doings of great men, events out of the common that stamped each place or region with character and gave it a distinctive atmosphere are the main themes.]

KEBLINGER, WILBUR. **Malta.** *Suppl. to Commerce Repts.,* Ann. Series, 1916, No. 20a, pp. 5-8. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

LOTTI, B. **Le tremblement de terre de la Marsica dans l'Apennin central.** Ills. *La Nature,* No. 2215, 1916, Mar. 11, pp. 161-163.

MASON, C. A. **The spell of southern shores, or from sea to sea in Italy.** x and 428 pp.; ills., index. The Page Co., Boston, 1915. $2.00. 8½ x 5½.

MODERNI, POMPEO. **Su la conca di Bolsena: A proposito di una nota del Dott. H. Simotomai.** Diagrs. *Boll. del R. Comitato Geol. d'Italia,* Vol. 45, 1915, No. 1-2, pp. 93-108. [On the "crater lake" of Bolsena, 50 miles northwest of Rome. The article to which this is a rejoinder appeared in the same journal, Vol. 44, 1914, No. 2.]

—— **Servizio Meteorologico, Norme ed istruzioni per il.** 61 pp.; diagrs., ills. *Ufficio Idrografico Pubbl. N. 53.* R. Magistrato alle Acque, Venice, 1916.

Viézzoli, Francesco. La Venèzia Giùlia. Map. *La Geogr.*, Vol. 3, 1915, No. 10, pp. 242-294. Novara.

Vitale, L. L'Adriatico, mare nostro. *L'Esplorazione Commerc.*, Vol. 31, 191 No. 6, pp. 206-222.

AFRICA

South Africa

—— Cape Province, Development of irrigation in. *Board of Trade Journ.*, N 1,031, Vol. 94, 1916, pp. 639-640.

Clerici, Alessandro. Igiene e medicina tropicale: Risorse naturali dell' Afric sud-occidentale tedesca. *Riv. Coloniale*, Vol. 11, 1916, No. 7, pp. 399-404.

Cordeaux, H. E. S. St. Helena: Report for 1915. 18 pp. *Ann. Colonial Rept No. 896.* London, 1916.

Dornan, S. S. Rhodesian ruins and native tradition. Ills. *South African Jour of Sci.*, Vol. 12, 1916, No. 11, pp. 502-516. [Abstracted in the January *Review*, p. 72.

Dye, J. W. Cape Town. *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 66 pp. 8-13. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washingto D. C.

Ellenberger, J. Bechuanaland Protectorate: Report for 1915-1916. 7 p *Ann. Colonial Repts. No. 898.* London, 1916.

Fox, H. W. The development of Rhodesia from a geographical standpoin Map, ills. *Geogr. Journ.*, Vol. 48, 1916, No. 4, pp. 289-305.

Gunsaulus, E. N. Johannesburg. *Suppl. to Commerce Repts.*, Ann. Series, 191 No. 66a, pp. 13-23. Bur. of Foreign and Domestic Commerce, Dept. of Commerc Washington, D. C.

Gunsaulus, E. N. Rhodesia. *Suppl. to Commerce Repts.*, Ann. Series, 1916, N 66a, pp. 23-31. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Wash ington, D. C.

Gunsaulus, E. N. Union of South Africa. *Suppl. to Commerce Repts.*, Ann Series, 1916, No. 66b, pp. 5-14. Bur. of Foreign and Domestic Commerce, Dept. of Com merce, Washington, D. C.

Heisler, C. H. British South Africa. *Suppl. to Commerce Repts.*, Ann. Serie 1916, No. 66a, pp. 1-8. Bur. of Foreign and Domestic Commerce, Dept. of Commerc Washington, D. C.

Kehoe, D. The influence of the climatic and tellurical factors on the distribu tion and spread of certain animal diseases, with special reference to the condi tions occurring in South Africa. *South African Journ. of Sci.*, Vol. 12, 1916, No. 1 pp. 474-501.

Kingon, J. R. L. Native agriculture. *South African Journ. of Sci.*, Vol. 12, 1915 No. 5, pp. 178-191.

Kingon, J. R. L. The economics of the east coast fever as illustrated by th Transkeian Territories. *South African Journ. of Sci.*, Vol. 12, 1916, No. 6, pp. 213 226. [The Transkei Territories lie "beyond" the Great Kei River on the east coast o the Cape of Good Hope province. The article is abstracted in the January *Review* pp. 72-73.]

Marloth, Rudolf. The effects of droughts and of some other causes on th distribution of plants in the Cape region. *South African Journ. of Sci.*, Vol. 12 1916, No. 9, pp. 383-390. [Records the effect of the remarkably severe drought of 191 in the Cape peninsula. The author's observations confirm the importance of the south east mountain cloud as a source of moisture.]

Masterson, W. W. Durban. *Suppl. to Commerce Repts.*, Ann. Series, 1916, No 66a, pp. 37-39. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Wash ington, D. C.

Muller, H. P. N. Did Holland sell the Cape? *Tijdschr. van het Kon. Nederl Aardrijk. Genoot.*, Vol. 33, 1916, No. 5, pp. 661-664.

Murphy, G. H. British South Africa. *Suppl. to Commerce Repts.*, Ann. Series 1916, No. 66b, pp. 1-5. Bur. of Foreign and Domestic Commerce, Dept. of Commerce Washington, D. C.

Pettman, Charles. An inquiry into the derivation of certain South Africa place-names. *South African Journ. of Sci.*, Vol. 12, 1915, No. 5, pp. 159-170 [Amongst the names is that of Walvis Bay. This form of spelling, authorized by th

›vernment, has aroused much etymological discussion. The author is satisfied that e earliest of the many forms is that of Walvisch Baai, which appears on Rochette's ıp of 1782.]

SCHWARZ, E. H. L. **The fault systems in the south of South Africa.** *South frican Journ. of Sci.*, Vol. 12, 1916, No. 9, pp. 367-382.

SPENCE, J. O. **Mozambique province.** 6 pp. *Suppl. to Commerce Repts.*, Ann. ›ries, 1916, No. 76a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, ashington, D. C.

STEWARD, T. A. **Swaziland: Report for 1915-16.** 15 pp. *Ann. Colonial Repts. o. 901.* London, 1916.

TOIT, P. J. DU. **South African agriculture: An analysis.** *South African Journ. of ›i.*, Vol. 12, 1915, No. 5, pp. 145-155. [The principal agricultural industries are briefly rveyed, some attention being paid to the complicated human factor in the history of e development. That population is a prerequisite for further expansion is the conısion of the writer.]

VERSFELD, WILLEM. **Notes on the chemistry of the !naras** ***(Acanthosicyos ›rrida hook.).*** Ills. *South African Journ. of Sci.*, Vol. 12, 1916, No. 6, pp. 232-238. The *!naras* (! represents a palatal click) is a cucurbitaceous plant flourishing in the ıne region round Walvis Bay. The features of its habitat are a dry, warm climate, cessant winds, loose sandy soil extraordinarily rich in potash, and a good deep-seated ıter supply. In its adaptation to desert conditions the plant has naturally become ghly specialized. It is characterized by enormous roots and the elimination of leaves. produces as fruit a small melon, an excellent nutritive food which with fish forms e exclusive diet of the Hottentot and Bushmen dwellers of the region. (See also ference in the note on "The Physical Subdivisions of Southwest Africa" in the ugust, 1916, *Review*, pp. 155-156.)]

WAKEFIELD, E. A. **Port Elizabeth.** *Suppl. to Commerce Repts.*, Ann. Series, 1916, o. 66a, pp. 32-37. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, ashington, D. C.

ASIA

TURKEY IN ASIA, ARABIA, CAUCASIA, IRAN

ARFIELD, WILLIAM. **The gate of Asia: A journey from the Persian Gulf to the Black Sea.** x and 374 pp.; ills. G. P. Putnam's Sons, New York and London, 1916. $2.50. 8½ x 6.

At the beginning of his book Mr. Warfield states that the object of his expedition was to pursue certain scientific studies" because he believes that "the unnoticed and mparatively insignificant mountains of Kurdistan form an important link between e mountain systems of Europe and Asia." The reader is nowhere troubled by these ientific studies, however, for the author devotes himself almost exclusively to a pleasant count of his experiences, interlarded with discussions of history. Before the war he arted from the head of the Persian Gulf, went up the Tigris to Bitlis and Van, and me back to civilization by way of Urmi and the Russian Caucasus. His volume is a pical book of travel. No remarkable adventures were experienced, no new routes were aversed, and no discoveries were made. Nevertheless it is worth reading.

Certain little episodes are highly illuminating. For example, Mr. Warfield saw an d Nestorian woman who was stolen from her Christian home in childhood, lived in a urdish harem, and had not seen a Christian for sixty years. He entertains no very gh idea of the Armenians, although he acknowledges their ability. He thinks that e village Armenians are largely of Parthian descent, and that the town Armenians are ırtly Jewish. The Kurds and Yezidis seem to appeal to him. His descriptions of ›ople are excellent.

One of the few scientific points upon which Mr. Warfield expresses an opinion is ıanges of climate. Many facts, such as the vast armies of Darius, and still more the ct that he brought to Arbela fifteen elephants from the present deserts on *this* side the Indus, "provide one of the most striking proofs of the tremendous variations hich have taken place in the climate of the whole northern hemisphere in historic mes." He states that "conditions in the southern hemisphere are of course the act opposite" of those in the northern, but of this he gives no proof.

ELLSWORTH HUNTINGTON.

BADER, R. H. **Persia..** 7 pp. *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 57a. ur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

CAPRA, GIUSEPPE. **La colonizzazione agraria in Siria e Asia Minore.** Ills. *alica Gens*, Vol. 6, 1915, No. 3-6, pp. 65-89. Turin.

Franchetti, Leopoldo. **Il futuro assetto dell' Asia Minore e le giuste aspi zioni italiane.** *L'Esplorazione Commerciale*, Vol. 31, 1916, No. 8, pp. 290-292.

Lukach, H. C. **Cyprus: Report for 1915-1916.** 23 pp. *Ann. Colonial Repts. 903.* London, 1916.

Raeburn, Harold. **A further list of peaks ascended in the Central Cauca in 1912, 1913, 1914, and 1915.** *Alpine Journ.*, No. 212, Vol. 30, 1916, pp. 194-196.

Schultz, Arved. **Afghanistan: Auf Grund einer Reise des Persers Rustam-b** *Petermanns Mitt.*, Vol. 62, 1916, Sept., pp. 330-333.

Totah, K. A. **Palestine and the Allies.** *Journ. of Race Devel.*, Vol. 6, 1916, 3, pp. 315-323. [Russian pilgrim, French economist, British politician have had int ests in the Holy Land.]

Watson, A. G. **Aden.** 7 pp. *Suppl. to Commerce Repts.*, Ann. Series, 1916, 49a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D.

—— ***Asia, 1:1,000,000. Compiled at the Royal Geographical Society under direction of the Geographical Section of the General Staff.*** Sheets: North—I— ***Bagdad;*** North—K—37, ***Batum;*** North—I—36, ***Beirut;*** North—J—37, ***Erzeru*** North—J—35, ***Izmir (Smyrna);*** North—J—36, ***Konia;*** North—K—36, ***Sinob;*** No —J—38, ***Tabriz.*** War Office, London, 1916. [These sheets represent a southeast extension of the Map of Europe, 1:1,000,000, discussed in detail in the *Bull. Am Geogr. Soc.*, Vol. 47, 1915, pp. 776-777.]

—— ***Asia Minor, Egypt, Mesopotamia and Persia, Bartholomew's map of.*** 1:4,000,0 John Bartholomew & Co., Edinburgh, 1916. [Excellent hypsometric map on a relativ large scale. The altitude tints, in the pleasing greens and browns generally emplo by this firm, are bounded by the following contours: 0, 500, 1,000, 1,500, 2,000, 3,0 6,000, 10,000, and 15,000 feet.]

—— ***Syrie, Carte de la (partie septentrionale), dessinee d'apres les cartes hyd graphiques de la Marine francaise, le Palestine Found*** [sic], ***les itineraires de E. G. Rey, Max Blankenhorn*** [sic], ***Sachau, Diener, les cartes de H. Kiepert, le Guide de Terre Sai du P. Barnabe, et les documents les plus recents.*** 1:400,000. Inset: Plan de Beyro 1:25,000. Missions Catholiques, Lyons, 1915. [Relief in brown shading.]

—— [***Turkey, etc.:***] ***Les operations russo-turques: Mer Noir, Crimee, Cauca Dardanelles.*** 1:850,000. Berger-Levrault & Cie., Paris, [1916].

WORLD AS A WHOLE AND LARGER PARTS

Fernow, B. E. **A brief history of forestry in Europe, the United States, and ot countries.** 3rd revised edit. xi and 506 pp.; index. American Forestry Ass Washington, D. C., 1913. $2.50. 8 x 6.

Why a history of forestry? Doctor Fernow gives the answer and the history.

The need of wood is universal, but the form that the forest problem takes varies fr place to place and from time to time. It varies locally within the same country beca of many conditions, prominent among which are the means of transport, the local ab dance of trees or of men. Changes in one of many factors may make a new fores situation.

Thus, the people of the eastern United States in 1800, though scanty in numb developed in some localities a keen appreciation of forest care because they depen on wood for fuel and timber and had only wagons and rivers for transport. Then ca the railroad and the steamship, and the Pennsylvania farmer, like the people of Engla drew upon the world. Forest care was forgot in the sense of plenty that the world mar gave.

That sense of plenty is passing, never to return. The north temperate zone conta the world's important forests, for, as Doctor Fernow well points out, the tropical wo are so hard that their uses are ornamental rather than economic. Of this temperate-z forest, 800,000,000 acres are in Europe, 800,000,000 in Asia, and 900,000,000 in No America. Already all Europe, except Norway, Sweden, Russia, and Austria-Hunga is importing, and North America with its heavy industrial development has made a w scarcity in an amazingly short time. This present economic life of ours, despite seeming mitigation of invention, demands ever-increasing piles of wood. Even Germa the fatherland of forestry, now imports a sixth of her supply and, like other Europ countries, increases her demand 1½ to 2 per cent per year. This import to Germ comes in spite of the experience of centuries, with 25 per cent of her area in fore nearly all well cared for and with the unusual output of over 50 cubic feet of wood acre per year.

The ray of hope for the race lies in the fact that only 10 per cent of the temperate-
ie forests, 250,000,000 acres, are under any care that may be called forestry. This is t a quick hope, as shown by the experience of the city of Nürnberg in one of the first corded cases—a crop of pine, spruce, and fir was planted in 1368, and harvested in 49, eighty-one years later.

Germany, populous and inaccessible (in comparison to the rest of Europe), early t the need for forestry. Her scores of states and cities with independent forest ministrations have made her a storehouse of experience, practice, and schooling. This d the experience of the rest of the world has been brought together in good German le by one eminently fitted for it, Professor Fernow, brought up in the schools and mosphere of Germanic forestry and fortified by decades of observation, practice, and aching in America.

J. RUSSELL SMITH.

MATHEMATICAL GEOGRAPHY

ASTRONOMICAL GEOGRAPHY

iAMBERLIN, T. C. **The origin of the earth.** xi and 271 pp.; diagrs., ills. (The University of Chicago Science Series.) University of Chicago Press, Chicago, 1916. $1.50. 7½ x 5.

This book is an interesting illustration of where one may be led in a scientific search. An inquiry into the cause of the Ice Age led to an investigation of the origin the atmosphere and from that to the origin of the solar system. The nebular hypoth-s proving unsatisfactory, the author advanced what he has called the "planetesimal pothesis." This was first published in 1897; since then many papers have been itten in developing the hypothesis into a theory. This volume is the first general position of the theory that has appeared.

The matter may be divided for review into four parts: (1) criticism of the nebular pothesis ;(2) development of a spiral nebula by the close approach of two stars, and evolution into the solar system; (3) origin of the larger features of the earth; (4) eculations on the beginnings of life.

(1) The nebular hypothesis was never developed into a theory; and during the cond half of the last century so many objections were found to it in the exact rm given by Laplace that astronomers looked to the irregular nebulæ and later to the iral nebulæ as a more probable prototype of the solar system. The author and Pro-ssor T. R. Moulton, his collaborator, showed that the distribution of mass and momenta the solar system were not compatible with the usual simple assumptions of Laplace's pothesis; they also emphasized the difficulty offered by the nearly universal forward tation of the sun, the planets, and their satellites.

(2) The solar prominences consist of matter erupted from the sun by some not early understood force. The author assumes that, if the pressure a little below the n's surface could be reduced, a sufficient mass would be ejected to form the planets and eir satellites, which, all told, only amount to about 1/745 of the sun's mass. The thor ascribes to the tidal forces due to the approach of a star the role of reducing e pressure.

There are three objections to this hypothesis: (a) The cause of the eruptions is known, and therefore a reduction of pressure might or might not increase their olence. (b) The action of the tidal forces is inadequately described; the radial com-nents of these forces have little effect in producing the tides, which are principally e to a heaping up of matter from the surrounding regions by the actions of the ngential components of the forces; and they are more apt to cause an increase than decrease of pressure on the levels from which the eruptions start. (c) The author es not tell us how large the star must be, nor how near the sun it must come, but he eaks of it as "massive" and its approach to the sun as "quite distant." In his Geology," he instances a star of the same mass as the sun and the nearest approach out ⅔ the distance of Neptune. The maximum ratio to the sun's gravity of the lal forces on the sun (due to this star) is one part in 32,000 million. If the star d four times the mass of the sun and approached to within half the above distance, e ratio would only be one part in a thousand million. Does any one doubt that the dinary storms on the sun cause much greater changes in the pressure than this would?

Assuming, however, that the ejections from the sun have occurred as described by e author, the theory accounts for the revolution of all the planets in the same direc-ns and approximately in the same plane, and shows that the growth of the planets, impact with small masses (planetesimals), would tend to reduce the eccentricities of e orbits, but it may be doubted whether this could produce the very nearly circular bits which all the planets describe. One of the most serious faults of Laplace's

hypothesis, according to the author, is that it would require retrograde, and not forwa rotations of the planets and revolutions of their satellites. The author explains forward rotations and revolutions as the result of impact of planetesimals on the grow planet; and points to the relative sizes of certain shaded areas in his Figure 7 "essentially decisive" of this. These areas have apparently been drawn on erroneous impression that the direction of the impulse is in the direction of motion the plane at the moment of impact. When the true direction of the impulse is determi by the instantaneous change in velocity, it is found that the effect of the impacts merely to reduce the speed of rotation of the planet, in whatever direction that rotat may have been. So that the direction of the axes and the directions of rotation of planets depend on the way the matter was erupted from the sun, of which nothing known; and the nearly universal direct rotations are not accounted for by this theo The author apparently recognizes the accidental directions of rotation of the lar planets (p. 154).

(3) The earth is supposed to have grown by slow accretions of planetesimals, wh cooled rapidly by radiation on account of their small size. The interior heat is ascri to a contraction of the mass, and a surface temperature gradient to heat brought molten rock from the deep interior and to radio-activity. Somewhat plausible reas are given why the heavier matter found lodgment in the depressed regions, and, greater compression there, made the positions of the oceans and continents permanen

The rate of rotation of the earth is supposed, towards the end of its growth, to h been diminished by accretions, and the depression near the equator and elevation n the poles, necessary for adjustment to the new figure of equilibrium, are supposed be accomplished, not by plastic flow, but by fractures of the earth into great segme By analogy with the jointing of basalt columns (!) the author thinks there would three great fractures at each pole, and that the whole earth would be broken up i six segments, diamond-shaped at the earth's surface, and interlacing in the equato regions; and that these segments would sway on their apices at the earth's cent adjusting the earth to its proper figure. As the earth shrinks, crushing occurs on land segments along the lines of junction of the segments, and mountain chains formed. The reviewer is quite incapable of understanding how the almost perfe ellipsoidal shape of the earth could be brought about by such movements of the s ments; nor do the fracture lines drawn by the author, more numerous than required the original analogy, follow the great structure lines of the earth; new hypotheses h to be introduced to account for these discrepancies. The three heavy segments of North and South Pacific and the Indian Oceans are supposed, by their weight, to h forced the segments opposite to them to yield, "and by such yielding to have form the land hemisphere," a perfect analogy to a man's lifting himself by his own b straps. In describing the certain forces which increase toward the earth's center author writes: "Their action was not unlike a vial closing from below," though, course, the forces acting on a body in the jaws of a vise are the same whichever approaches the other. But perhaps the author should be forgiven this error, for it remarkably prevalent in geologic literature.

The author recognizes the purely speculative character of many of his ideas, a writes: "We are painfully conscious of the high probability that we have fallen i some misconceptions, perhaps not a few, and have entertained views that will need to rectified."

HARRY FIELDING REID

EDUCATIONAL GEOGRAPHY

HAWORTH, ERASMUS, AND OTHERS. **Should a new degree be created for profi ency in geology?** *Economic Geol.*, Vol. 11, 1916, No. 1, pp. 73-86. [Opinions elici by a circular letter on this question.]

KELTON, M. E., AND C. W. HOTCHKISS. **An experiment in fourth-grade geograp** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 7, pp. 245-251.

KIRCHWEY, C. B. **Geography in the junior high school: Its relation to e mentary school and to senior high school geography.** *Journ. of Geogr.*, Vol. 1915-16, No. 8, pp. 291-294.

LANGEN, GUSTAV. **Die städtebaulichen Einheitspläne als Lehrmittel.** *Geo Anzeiger*, Vol. 16, 1915, No. 11, pp. 331-334; No. 12, pp. 364-367.

MCARTHUR, L. A. **Accuracy in geography.** *Mazama*, Vol. 4, 1915, No. 4, pp. 47. [Deals with the work of the U. S. Geological Survey and the U. S. Coast Geodetic Survey, and the giving of geographic names, mainly with reference to Pacific Northwest.]

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ꝛIBAL DISTRIBUTION AND SETTLEMENTS OF THE FUEGIANS

Comprising Nomenclature, Etymology, Philology, and Populations

By CHARLES WELLINGTON FURLONG, F.R.G.S.

We have already delved a little into the mists enshrouding the history the peoples of Patagonia and the Fuegian archipelago.[1] We have seen e foot peoples, clad in furry guanaco skins, make the long journeys south er the wind-swept pampas of what is now Patagonia and into northern ıd southeastern Tierra del Fuego, the men with lances and long bows yward pointing and *boleadores* coiled for the march about their waists, e women in the vanguard bearing back-burdens of folded tents or babes the neck folds of their *capas* (skin cloaks), with older children folwing at their sides. With no domestic animals, save perhaps a dog, they ıve followed the road where the foothills meet the plains, the tag ends their skin garments and their long black hair blown in the pampas inds.

We have seen the canoe peoples, stark naked to the wet and freezing lasts or, at most, clothed in a couple of scant otter skins flung over their owerful shoulders, work their way south through the long, tortuous chanels of the west coast clear to Cape Horn, the southernmost habitat of ıan. We have watched their slow progress; the men in the fore part of ıe canoes ever ready to spear their prey; the women paddling astern; ıe eternal-fire smoke rising from the sod amidships—fire for cooking, ɔr warmth, or for perpetuation during their voyages.

Today we find them divided into four distinct tribes, each occupying definite habitat. It is the purpose of this article to define more clearly he territories occupied by these Fuegian tribes, to touch on their nomenlature and philology, to consider their decrease and its causes, and to

[1] See the article by the writer on "Some Effects of Environment on the Fuegian Tribes" in the anuary *Review*.

›scribe and locate their principal settlements before they are obliterated. he region which these tribes occupy—the archipelago lying south of the trait of Magellan—I have defined as Fuegia. The largest island is Tierra el Fuego, triangular in shape and about as large in area as New Hampshire nd Vermont combined. West and south of it are thousands of smaller lands and intricate waterways, but Tierra del Fuego itself contains about vo-thirds of the land area of the archipelago, which lies between 52° 28′ nd 56° S., i. e. in a corresponding latitude to southern Labrador. Politi- ılly, Argentina claims the eastern half, Chile the western.

The nomenclature of Fuegia comprises two divisions, those names given y the intrusive European element and those given by its autochthonous ıhabitants. Perhaps the place-names of no territory in the world por- ·ay the history of a region as do those of Fuegia:—Magellan Strait, Use- ss Bay, Beagle Channel, Mount Darwin, Port Famine, Thieves Bay, Deso- tion Island, etc. Those of Indian origin are mostly limited to the prin- pal native settlements, headlands, channels, etc., of which they are gen- ·ally geographically descriptive. For instance, Ushuaia (Oo-shoo-wy′ yä) eans, in the Yahgan language, "Mouth of the Bay"; Yahga-Ashaga eans "Mountain Valley Channel."

It is said that when Magellan sailed through the strait now bearing is name he was so impressed by the blue smoke of the numerous camp ıd signal fires rising against the dank, dark mountain sides that he amed this region Tierra del Huomo (Land of Smoke.) When his lone ıip returned to Spain the king was advised of this. "Tierra del Huomo?" ıeried His Majesty. "No, Tierra del Fuego; where there is smoke there ıust be fire." The name, however, was undoubtedly given by Magellan › the lands bordering both sides of the strait.

Prior to venturing through the stormy strait Magellan's fleet wintered ı little San Julian Bay, on whose shores his crews one morning discov- ·ed exceptionally large human footprints; hence the Spanish term Pata- ›nes (the big-footed) was applied to the inhabitants. From this word as later derived "Patagonia," which term even on recent maps has been pplied not only to the pampas reaches to the north of the strait, but to ıe more open country of the northern half of Tierra del Fuego, of which ıey are a continuation.[2] It must be remembered that for nearly a cen- ıry after Magellan discovered the strait Tierra del Fuego was consid- ·ed as the northern extremity of another continent reaching still farther ›uth. Subsequent explorers or mariners have applied the term "Pata- ›nian" indiscriminately to natives, both foot and canoe, inhabiting both des of the strait, thus confusing not only the Onas with the Tehuelches, ut even the canoe peoples with the foot peoples. Even the observant

[2] "Patagonia" is also applied to the southwestern Chilean coast. For a discussion of the application the name see H. Steffen: Viajes de Esploración i Estudio en la Patagonia Occidental, 1892-1902, Vol. 1. ›2, pp. 3-9, Santiago, 1909.—Edit. Note.

Darwin made no distinction between some of the foot people of south eastern Tierra del Fuego (probably Haush) and the Yahgans, while Fitz roy and others, without sufficient foundation, have classified the cano peoples into a number of different tribes, such as—to retain the origina spelling—the Yapoo Tekeenica, Alikhoolip, Chups, Yacana-kunny, Key yus, Sehuau-kunny, Zapallo, Tekeeniea, Peeherais, Huemul, Poy-yus Yamana, Aonik, Aona, Yacanas, Yacana.

Thus it may be seen how a confusion of geographical names cause and still causes grave errors in the reports on tribes inhabiting these land Consequently, great discrimination should be observed in the use c Fuegian data gathered from records of mariners and others, because c the confusion of geographical and tribal names as well as on account c the observers' limited association with the natives.

After careful consideration, I have adopted and would recommend th following nomenclature as applied to the Fuegian tribal names, territor and language, each of which will later be considered in detail. (For th territorial distribution of the tribes see the map, Figure 2, in the prev ous article.)

Tribe	*Territory*	*Language*
Yahgan (Yäh'gan)	Yahgana (Yäh'gä̤-na̤)	Yahganan (Yäh'gä̤-na̤n)
Ona (Ō'nä)	Onia (Ō-nee'ä̤)	Onan (Ō'na̤n)
Alaculoof (Al'a-cooloof)	Alaculoofa (Ala-cooloof'ä̤)	Alaculoofan (Ala-cooloof'a̤ı
Haush, or Aush (Howsh)	Hausha (Howsh'ä̤)	Haushan (Howsh'a̤n)

The Alaculoof Tribe

The name of this tribe has been spelled in various ways, Alacoolo Alacaloof, Alacaluf, Alacooluf, Alacalouf, Alcaluf, Alikhoolip (Fitzro 1836), Alaculoof (Hatcher, 1901), Alookooloop (Skottsberg, 1908), Aluk lup (the same, 1913).[3] Bridges, an early missionary, to whom mo detailed reference will be made shortly, spelled it Alaculoof. As I co sider Bridges by far the greatest authority on the canoe peoples, I hav adopted his spelling. The name seems to be the one applied to them l the Yahgans, who probably derived it from the Alaculoofs themselves.

Alaculoofa, their territory, adjoined Yahgana and may be said to hav reached from the vicinity of Brecknock Peninsula west and north, possib well up the Patagonian channels, with a slight overlapping around Brec nock Peninsula into Yahgana, and an occasional extension south and ea as far as Murray Narrows off Beagle Channel. The Alaculoofs were can Indians: the mountainous, damp, and densely wooded islands, unfavorab for pasture or tillage, turned them to dependence on the sea for the main food supply. Such an existence necessitated a roving life; so the time was spent cruising the tortuous channels and innumerable bays their habitat, camping on the edges of its many islands. Today many

[3] Observations on the Natives of the Patagonian Channel Region, *Amer. Anthropologist*, N. S., Vol. 1913, pp. 578-616.

Fig. 2.

Fig. 3.

Fig. 2 A Tehuelche camp, southern Patagonia.

Toldos (tents) are made of guanaco skins, fur out, and are always pitched back to the west, from which come the prevailing winds. Note undulating pampas country. (The Tehuelches are dealt with in the writer's previous article, in the January *Review*, pp. 2-3.)

Fig. 3—Types of Yahgans, Rio Douglas. Note primitive beech-bough wigwam and mourning face-painting of woman standing. (Photo copyright by Charles Wellington Furlong.)

their kitchen-middens are found on the most protected and desirabl camp sites.

The Alaculoofs, though slightly superior to the Yahgans, resemble them in general appearance, customs, and character, but less is known o these people than of the other Fuegian tribes. Skottsberg states[4] tha the canoe Indians, as they are called by the English, call themselve "Alookooloop" and that they live in "the channels between the Magella Straits and the Peñas Gulf." But it must not be taken for granted tha all the canoe people of the Patagonian archipelago are Alaculoofs. N adequate linguistic studies have been made nor ever can be made unles some well-trained ethnologist of an adventurous nature is willing in th very near future to isolate himself for an extended period of time amon these people. About 1884, the Rev. Thomas Bridges and his son Despar compiled an Anglo-Alaculoof dictionary which seems to have disappeared While at Rio Douglas at the camp of a solitary missionary, Mr. Joh Williams, I saw a manuscript dictionary, by Bridges, in his possession While this dictionary seemed to comprise mainly Yahganan, part of it may have been devoted to Alaculoofan, and it may be the missing dictionary. One of the leading authorities, and perhaps the foremost authority of this country, on the linguistics of the Fuegian tribes is the Rev. John Cooper of Washington. He has informed me of a manuscript book of prayers in Alaculoofan recently compiled by Brother Juan Xikora of Dawson Island Mission. Announcement has been made that this book is to be published.

Skottsberg, in his interesting report on the Swedish Magellan Expedition,[4] says: "It is very astonishing that two tribes having the same aspect and customs, living in the same region and not separated by any natural obstacles, should have their languages so entirely different as the Yahgans and Álookooloops, not one word being the same." I must take exception to two statements in the above: first, Brecknock Peninsula was a tremendous barrier to intercommunication between these two tribes. With an annual record of "three hundred days of rain and storm and the other sixty-five not pleasant," rounding in frail canoes the weather side of the frowning cliffs of Brecknock Peninsula was something which only the most daring or hard-pressed undertook. And it was impossible for these canoe men to pass over its barren, unexplored mountain heights. It seems well established that the Yahgan language extended (1876) to Brecknock Pass, where Alaculoofan began. Second, while it is my opinion that Alaculoofan and Yahganan are absolutely different, Skottsberg's statement would advisedly have been made with greater reserve. Such a comparative statement cannot justifiably be made until one has mastered to an appreciable extent both these languages. With due respect to Dr. Skottsberg's con-

[4] The Swedish Magellanian Expedition, 1907-1909: Preliminary Reports, *Geogr. Journ.*, Vol. 31, 1908, pp. 640-645, and Vol. 32, 1908, pp. 485-488 and 591-594; references on pp. 592 and 593.

entious and valuable work in those regions, his data were based at the ıst on but a few weeks' contact with these people. Bridges took a life-ıe to compile his Anglo-Yahgan dictionary and grammar.

An idea of the decrease of the Alacaloofs and the other Fuegian tribes ıy be obtained from the following table:

TABLE SHOWING POPULATION STATISTICS OF THE FUEGIAN TRIBES

TE	ALACULOOFS	YAHGANS	ONAS	HAUSH
36	400 about (Fitzroy) 3500+? (Furlong)	500 about (Fitzroy)	3500? (Furlong)	200 to 300? (Furlong)
14	....	1500? (Martial)		
54	....	2800 about (Bridges)		
52	....	3000 (Denucé)		
59	3500 to 4000 (Bridges)	2500 (Bridges)	3600+ (Bridges)	
79	3000			
80	3000 (Bridges)			
84	....	1000 (Martial) 945 (Bridges)		
90	....	300 (Hyades and Deniker)	2000 (Barclay through Bridges)	
91	....	....	....	100 about (Furlong)
00	....	....	800 (Barclay through Bridges)	
03	1000.................	200 (Barclay through Bridges)		
04	800			
08	300 or more (Skottsberg)	175 (Furlong)	600 about (Furlong)	2 (Furlong)
10	....	175— (Furlong) 80? (Lehmann-Nitsche)	600— (Furlong)	
12	60 (Lucas Bridges)			5 or 6 (Lucas Bridges)
16	200 ? (Furlong)......	100—? (Furlong)	800—? (Furlong)	

Question marks indicate theoretical estimates.

he Alaculoofs have been decimated through rum and disease, the effect contact with ships' crews, with whom they barter skins for clothing, bacco, and liquor. They have practically disappeared from Fuegia, only few individuals being found in Yahgan territory. An occasional canoe two is seen at the western end of the Strait of Magellan. More are ound, however, in the Patagonian channels between the strait and the ulf of Penas. Within the last eight years some of these people have been efinitely located in the region of Last Hope Inlet, Port Grappler, Cape amar, and the vicinity of Sholl Bay, Dawson Island, Beagle Channel, urray Narrows, and elsewhere.

There is good reason to believe that some of the Alaculoofs occasionly worked eastward from Admiralty Sound overland to Lake Cami Fagnano) in Tierra del Fuego; consequently I include the shores of that ke in Alaculoofa. Skottsberg counted some eighty of these canoe people etween the Strait of Magellan and the Gulf of Penas. Judging by those ccasionally reported, it would seem that between the regions of Last ope Inlet and Beagle Channel they number from one to two hundred. ut should the bulk of these people have retreated into the intricate maze f the Fuegian and Patagonian archipelagoes, it is possible that several

hundred of the tribe may still exist. I incline to the lower estimate. M
scientific work is still to be accomplished along the entire length of
Patagonian channels between 41° 30′ and 50° 30′ S., as well as in the li
known regions south of the strait and back of and about Hoste, Clare
Santa Ines, and Desolation Islands.

The Yahgan Tribe

The name of this tribe has also been spelled Yaghan and Yagan.

To Bridges belongs the credit of the first proper linguistic classifi
tion of the four Fuegian tribes. The canoe people inhabiting the C
Horn and Beagle Channel districts spoke a common language, call
themselves just *ya′mana* (man) and their language, *ya′man′hah′*
(man's voice). The central and main thoroughfare connecting these
districts is a narrow channel known as Murray Narrows, called by th
natives Yah′ga-Asha′ga, meaning "Mountain Valley Channel," all
district round about being known as Yah′ga. To distinguish this tr
from the others west, north, and east, Bridges called them "Yahga
wisely adopting, in the case of a tribe, a custom applied by them to
dividuals, for their names mostly are taken from the place of birth.
instance, a Yahgan of my expedition was from this group and from Yah
as his name, Yahga-Ashagan, indicated. Bridges also states that th
called their language *yatigan*, but for consistency's sake I have adhe
to "Yahganan," the term used in the synopsis (p. 172).

Mr. Bridges was a man of keen observation, excellent education, an
strong scientific trend. His Anglo-Yahgan dictionary and grammar, wh
is based, with certain modifications, on the Ellis phonetic system, is one
the most comprehensive and valuable works on a primitive language.[5]
comprises practically the entire Yahgan language and shows an am
ingly large vocabulary—about forty thousand words—for so primitive a
isolated a people. This is due in great part to their forced lack of grega
ousness, and hence undeveloped classification of objects and ideas: th
terms are specific; they compound verbs and adverbs almost indefinit
and have innumerable modifying affixes. In strong contrast to the g
tural tongue of the Onas, their language abounds in the vowels and c
sonants of our own language and their speaking voice is pleasing and s
Although numerous names have been applied indifferently to vari
groups of Yahgans, sealers, explorers, and missionaries often defining th
by the names of their settlements, there seem to have been among th
four principal groups. These are the Beagle Channel and Murray Narro
group, who are the best formed; the Lennox Islanders, big-headed, ug
powerful men; the Southwesterns, about Hoste Island, the most warl

[5] The relation of the subsequent peregrinations of this dictionary, and of its acquisition by
Frederick A. Cook, when a member of the *Belgica* Antarctic Expedition, is a story in itself. But let i
unqualifiedly understood that no person other than the Rev. Thomas Bridges can morally or legally cl
any credit whatsoever for this superb work.

and murderously inclined; and the Wollaston Islands group, the most wretched and most dwarfish. The last bear out specifically, in the case of a group, the migratory principle that I advanced in the previous article in the case of the southern South American tribes, i. e. the weaker are forced south. Through decimation, social instinct, and the necessity for wives, these groups have mingled to a considerable extent, particularly the last

FIG. 4—Map of Tierra del Fuego showing some Ona, Yahgan, and Haush settlement sites. Scale, 1:4,800,000. *Note:* The site at Cape San Pablo is an Ona site and should be represented by a triangle.

Names have been given to these sites whenever possible. All are aboriginal names except the following: Gente Grande, Rio Fuego, Haberton, Cambesceres, Banner Cove, Rio Douglas, Mussels Bay, Button Island. The exact location of Lushoof is doubtful. Cuehawulaf is the name applied to the island and probably to its principal camp site. There are many other settlement sites not shown here. Some of those shown have been abandoned. With one or two exceptions these are or have been important settlements, supporting a fluctuating population, varying from a few families to perhaps over three hundred in case of the Yahgans, to perhaps one hundred in case of the Onas, but usually only small groups in the case of the Haush. Note the center of Yahgan population in Yahga and vicinity.

three, who now have their principal rendezvous at Rio Douglas (Navarin Island) and on Tekenika Island in the Wollaston group. Today the Beagle Channel groups also intermingle to a considerable extent, and even an occasional Alaculoof is found among them.

Their principal camp sites and settlements may be readily located by the kitchen-middens found along their coasts. These mounds mark the old resorts of the tribes and are composed of mussel and limpet shells and bones and refuse thrown out from their wigwams. They also served, at

least to some extent, as graves in which they buried their dead. It mus[t] have taken many centuries to bring about some of these vast accumulation[s.] The study of these kitchen-middens might throw light on the early histor[y] of these people, and an important systematic study should be made o[f] the shell heaps before their contents have rotted away. This must be don[e]

FIG. 5—View at southern end of Woolyia, taken from point A on plan (Fig. 6) and contained in range of vision as there indicated by the dot-and-dash lines. Compare middens, canoe runways, and fish traps with plan. A large midden is shown in foreground, others may be observed on land end of promontory to left and covering point and part of coast of Phillips Island. (Photo copyright by Charles Wellington Furlong.)

soon, for those abandoned in even comparatively recent times are overgrown with shrubs and trees.

Although families have camped on the coasts of almost every inlet, bay, and channel of Yahgana there have been a number of principal settlements. These are indicated on Figure 4. Undoubtedly the largest settlement was that of the Beagle Channel group at Ushuaia ("Mouth of the Bay"), now the site of an Argentine penal colony and the southernmost town in the world. There is a record of one occasion when the temporary Yahgan population there reached over three hundred. About one hundred and fifty was the usual number, while in the course of a year fifteen hundred canoe people sometimes visited this place to barter skins.

With the possible exception of the Yahga region, Woolyia (Woo-ly'yä) on Navarin Island was the principal settlement of the Murray Narrows region. Today the bare poles of a lone abandoned wigwam, from which a few dry leaves still flutter in the wind, are all one finds of this former settlement. For centuries the theater of considerable primitive activity, the scene, too, of the massacre of the ill-fated officers and crew of the *Allen Gardiner*,[6] over whose shallow grave I erected a rough-hewn tablet.

[6] See the volumes of the *South American Missionary Magazine*.

e Woolyia site is now devoted to the horticultural efforts of an adnturous Austrian.[7] I viewed it from an elevation at the northern end. general appearance suggested the old irregular palings left by a ming dredge, now overgrown somewhat with moss, short grass, and in a few stances with caliphate bushes.

FIG. 6—Approximate plan of Woolyia, an important Yahgan settlement site on Navarin Island, Tierra l Fuego. Scale, approximately 400 feet to 1 inch (1:4,800). *Note:* The unnamed island in the northern rt of Allen Gardiner Bay should be designated Cole Island.

This map was drawn from a hasty plan, sketched on the spot by the writer during his expedition of 07-08, and may be regarded as a typical Yahgan settlement, being second in importance only to Ushuaia. cation, 55° 3′ 0″ S. and 68° 9′ 30″ W. Stippled areas represent kitchen-middens and ground covered with eir débris. Islands are low promontories, or hills, practically all being very rocky and wooded. Compre with photograph (Fig. 5) taken from point A. In the past, the settlement varied from a few Yahgan elters to probably sixty or seventy; its population varying sometimes from a few families to over two ndred natives. B represents canoe runways, cleared of stones: C, what may have been fish traps, ough possibly runways (those on the opposite, southern, side of the point, which are left unlettered on e map, should be included); D, the expedition's chartered 35-foot sloop *Garibaldi:* E, the grave of white en of the ill-fated *Allen Gardiner* expedition, who were massacred by Woolyians (here the writer placed wooden tablet with an inscription); small dotted rectangles at F, dwelling of an Austrian settler, ntonio Vrsalovich, who came here in 1896; large dotted areas at F, fencing; G, small mill and straighted stream, forming its raceway.

In absence of charted names of the bay and islands, the writer has named them as follows: Allen rdiner Bay, after the mission vessel; Garibaldi Island, after the sloop of the expedition; Yescoosee land, which Vrsalovich said the Yahgans called it; Fell and Phillips Islands, after Captain Fell and r. Phillips, victims of the Woolyian massacre; and Cole Island, after the cook who was aboard the hooner and escaped in a small boat past this island and by taking to the woods on the opposite point.

Perhaps no more ideal settlement site exists than Woolyia, and I shall ake it as a type (Figs. 5 and 6). At the head of a large sound (Ponsonby), n the canoe routes between the Wollaston Islands and Beagle Channel, nd protected by islands, it possesses the most ideal topographic and limatic elements from the Yahgan point of view. It is situated along

[7] See the review of the *Anuario Hidrográfico de la Marina de Chile* for 1915 in the November *Review* Vol. 2, p. 391). The report states that the Austrian had been settled there for sixteen years: presumably is enterprise is successful.

the west coast of Navarin Island, on a little bay protected by a penins from the south and southwest gales. In the bay, from a hundred to p haps a few hundred yards off shore, are about a half dozen small islan varying in length from a few yards to possibly an eighth of a mile. Th afford protection from the west and northwest gales and also form a splen little haven with an entrance at either end.

The village extended several hundred yards from a point north to yond the peninsula on its south, and from high-water mark back ab one hundred yards to what may have been originally the wood line t had cleared about the village. Edging the clearing of the settlement its are the dense woods whence the Yahgans obtained their supplies of fi wood and moss for kindling, a few meager berries, scurvy grass, wild ery, and edible fungi, beech boughs for their wigwams, bark for th canoes, wood for their spear shafts, etc. A number of fresh-water strea pass through the camp site, while remnants of stone fish traps and ca runways, cleared of stones, can be seen at low tide. A few small mars tracts covered with balsam bog alternate with the groups of kitch middens. One of these marshy tracts, I presume, may have supplied th with the *carex* used in the weaving of their reed baskets. Other adv tages of this site were the abundance of mussels and the favorable con tions for gathering them. This important food is secured to a great ext by the women, who dive for it into the icy brine. The comparatively qu water necessary was here secured by the island shelter before mention

The mussel heaps of the village site are scattered not only the ent length of the shore of the bay, but are on the landward side of the larg islands. Some of these shell heaps to the north are at least eight f high, possibly ten, and could be circumscribed by a circle thirty-five forty feet in diameter. A very large midden at least ten and possil twelve feet high is noticeable on the large island opposite the penins to the south end of the village. In excavating the shell débris of th middens I found bones of whale, guanaco, and birds, and some implemen A cranium, with its lower jaw, found in a shell heap in the central p of the village, with finds of like nature and other data gathered, indica that the occupants buried their dead in these middens.

Most important of my finds was one of the so-called "morning sta stones. This perforated stone, about four inches in diameter, has knob projections around its rim, and was probably the head of a primitive w club. It is now in the American Museum of Natural History, recordi the southernmost of these stones yet found (55° 0′ 3″ S.). It may he in establishing the fact of certain trade relations and communications tween the ancestors of these people and tribes of the Chilean coast. far north as the country of the Mapuches—perhaps to northern Peru.

At the mouth of Rio Douglas and at frequent intervals on both sid up river for a mile or more I also found large groups of kitchen-midde

me of them overgrown and hidden with weeds, bushes, and trees. Anher large site was at Tekenica in the Wollaston Islands and Mussels ay in Beagle Channel. This latter is still occupied by Yahgans, as is so their camp site at Laui (Lao'we).

From the dim past the Yahgan has fought a winning fight against the islaughts of the elements, combating them with all the dogged aggressiveiss of his powerful frame, but the contact with "civilization," though ight, has proved more fatal than nature. Clothes and hair cuts have proiced catarrhal afflictions, pleurisy, phthisis, pneumonia, scrofula, and insumption; clothes, those catch-alls of germs, have introduced measles, hooping cough, and smallpox, while unscrupulous adventurers with their itten rum and more rotten morals have left in their wake some of the hite men's vices, syphilis and other virulent forms of venereal diseases, ore fatal than his bullets. A little less than half a century ago there ere probably 2,500 Yahgans. In 1907 and 1908 I estimated the total opulation at 175. In 1910 it had decreased slightly. Today possibly not iore than 100 remain. Yet this remnant maintains its independence in ie very face of extinction, even continuing its blood feuds, increased by ie necessity of greater community life and the fight for wives. Further thnological work should be done and done quickly among these people efore the last of them disappear. Their shell heaps should be plotted nd portions of them systematically excavated and studied before they re overgrown with brush.

The Haush Tribe

The Onas speak of themselves as *Shilk'e'num* or as *Ch'on* (Tchon; *o* rolonged), their word for "men" in general. But the tribe dwelling in he southeast corner of Tierra del Fuego they call *Haush* or *Aush.* This ord has no other significance in Ona. The Yahgans call the Haush *Etulum Ona* (eastern Ona). In Yahganan the word *haush* means "kelp," he long-stemmed, flat-leaved seaweed abounding along their coasts, in)na *ch'ish.*

The Haush were not a strong foot people, nor a canoe people, though here seems to be some evidence that during the quieter season of the year ome of them used canoes. Driven as they were to this extremity of Tierra lel Fuego they were forced to subsist on the meager products of their coast, nainly on the shell fish and creatures living in and about the kelp, while hey clung, like the kelp itself, to the coastal fringe. It is not improbable hat the Yahgans, who are adept at nicknaming and seeing similes, should iave drawn an analogy between these people and the coastal weed and iave applied the word *haush* to this tribe as an appellation of contempt, ust as today the white people of the Patagonian mainland speak of the Falkland Islanders a bit contemptuously as "kelpers."

The Haush were intermediary, so to speak, between the Onas and

Yahgans, and it was only along Haush territory in times past that t
Ona met and traded with the Yahgan. May it not be reasonable to su
pose that through these meetings the Yahgans in speaking to the On
contemptuously referred to the inferior eastern tribe as Haush (kelp), a
that this word thus became incorporated in the Ona language as the na
of these people?

A point in favor of this verbal adoption theory lies in the fact that all
the Ona people were named by the Onas according to locality or conditio
of locality under which they lived, such as *Parek u Chon* (Forest Pe
ple) or *Coj u Chon* (Beach People), while "Haush," having no oth
significance in Onan, indicates that it might be a word borrowed fro
Yahganan, in which language it has a definite significance applicable to t
Haush tribe.

The history of the Haush may be said to have begun with Darwin
meeting with some members of the tribe in Good Success Bay in Dece
ber, 1832, but he seemed to make no distinction between them and t
Yahgan tribe. The next record of contact with them is made by Bridg
at Good Success Bay in 1878. He was the first man to give to science t
name of this tribe. Linguistically the Haush differed from the oth
tribes; a few words evidently were in common use between them and t
Onas, and in respect of its harsh and guttural nature the Haushan r
sembled the Onan tongue. Bridges incorporated between five and six hu
dred words of Haush in the manuscript of his Anglo-Yahgan dictiona
and grammar under the heading of "Eastern Ona."

The Haush were divided into family groups averaging perhaps five
six to a family and were scattered mostly along the coasts from Go
Success Bay to Cape San Pablo: at times they may have worked the
way as far east as Sloggett Bay or farther. Their principal settlemen
undoubtedly were Good Success Bay, Cape San Diego, Thetis Bay, Fal
Cove, Policarpo Cove, and here and there along the coasts between th
cove and the vicinity of Cape San Pablo. These people were evident
similar in customs and social organization to the Onas, though at an inferi
stage of development.

When on the south coast of Tierra del Fuego in 1908 I found only tw
Haush living: a man, Pelota by name, probably about sixty years old,
Haberton, and his son, a sickly youth about twenty-two, living among som
Onas at Najmish to the north. In 1912 I was informed by Lucas Bridg
that there were about five Haush living. But it is quite possible th
in his estimate of the five Haush Mr. Bridges not only included the tw
Yahgan wives of old Pelota, but the Ona woman or wife the young
Haush may have acquired; this would tally with his estimate. The so
was evidently a half-blood, so the older man, if still living, is the last pur
blood member of the Haush tribe.

THE ONA TRIBE

Onia, the territory of the Onas, formerly extended over the most de-
irable portions of Tierra del Fuego. Now driven south by white men,
he Onas occupy the greater portion of the southern half of their island,
orested and mountainous. Had it been like the northern half, the world
ight now look upon the hunting grounds of an extinct race.

Although Magellan undoubtedly saw the smoke of the Onas' camp
res along the strait, he evidently never came in contact with any of this
ribe; even centuries after Magellan's time their island was a *terra
ncognita,* and some parts of it still are. The history of the Ona in north-
rn Tierra del Fuego practically begins with certain Argentine expedi-
ions and the establishment of the first sheep ranch at Gente Grande (Big
Ien) about the early eighties. Since then we have received numerous
ragmentary reports of these "chunkies," as they were called by the
anchers, whose closest analysis of this splendid tribe was too often along
he sights of a Winchester or Remington.

While ethnic work has been done by an occasional scientist or explorer[8]
long the coasts, it fell to my lot to be the first to pass through certain
nterior sections of their country alone with Onas and to travel, hunt,
nd live in their wigwams for the purpose of ethnological study.[9]

The origin or meaning of the word "Ona" is a somewhat mooted ques-
ion. The Onas, as has been said, call themselves *Shilk'e'num* or *Shelk'-
nan,* meaning "men." *Os'isn* they call the land over which they roam.
Ianni in Yahganan means "north wind," but *Onan* means the same; the
'ahgans may have come to use the latter as signifying the wind from the
)nas' land, which lies to the north of their territory. The Yahgans speak
f the northern Ona as *Ingulum Ona,* and of the Haush, as we have seen, as
'tulum Ona (eastern Ona). The Yahgans of Beagle Channel and Woolyia
poke of the Onas as *Ō'wen* or, on learning the English word for men,
'wens men, or *Ōensmen.*

The Onas called Yahgan men *Wō'wun.* This may have been another
orm of the Ona word for men, *Chō'wun.* As the Yahgans had but one
'ord in their language for men, *yamana,* they may have considered that
he Onas too had but one word for men, *wowun,* and consequently applied
to themselves, deriving from it the Yahgan word *Ō'wun, Oen,* or *O'wen.*

The Ona word *Chō'n* (Tchō-n) or *Chō'wun,* meaning men or people,
ight have been corrupted by way of the Haush to *Ona,* as the *ch* is a sort
f click and but slightly audible. But I am inclined to believe that from

[8] For accounts of scientific expeditions to these regions, see Lautaro Navarro Araria: Censo Jeneral
el Territorio del Magallanes, Punta Arenas, 1908, Vol. 2, pp. 503-507.

[9] Results of this expedition consist of collections in the American Museum of Natural History; Pea-
ody Museum, Harvard University; Peabody Museum, Salem, Mass.; Museum of the American Indian,
eye Foundation, New York. Other important collections are to be found in the Salesian Mission
useum, Punta Arenas, Chile; Museo de la Plata, La Plata, Argentina; Museo de Buenos Aires, Buenos
ires, Argentina, and small collections in the National Museum in Washington, in the British Museum,
id in Paris.

Cho'n the Yahgans derived their word *Ō'wun, Ō'wen,* by which they lon signified the Onas. There is a possibility of *Ona* having been derived fron *Ts-ōn'aca,* which the Tehuelches called themselves, the corruption of th two central and emphasized syllables of the word having come to th Yahgans by way of the Alacaloofs as the name of the foot people of th strait region.

However, the word "Ona" was accepted by Bridges, who not onl knew the Yahgans better than any one else, but, in 1875, was practicall the first white man to get into friendly touch with a few of them.

There may be slight dialectic differences among some of the mai Ona groups, but Onan is distinct from the other Fuegian languages. Un like the Yahgans, the Onas do not take their names from their birthplaces except in the case of their *j'hō'n* (medicine men). Their speech is in describably guttural, unmusical, and full of clicks similar to those of th Zulus, the *sh* and *ch* sounds being prominent.

The most desirable hunting grounds of Onia, those over which th guanaco roamed in countless thousands, lay in the northern half of Tierr del Fuego. To a limited degree they extended into the southern half, bu this section consists mostly of bog lands, screened by thick woods and i many places by impenetrable forest, while range upon range of impassabl snow-capped mountains swing nearly clear across its southern length fro west to east. Some Onas undoubtedly frequented the eastern end of th large interior lake called by them Cami (Lago Fagnano). About it shores they found fair hunting and undoubtedly came in occasional con tact with a few Alacaloofs who had worked in from Admiralty Sound an who may be considered the discoverers and first explorers of this sixty-mil long body of water. Except at the extreme eastern end of Tierra de Fuego there was but one pass over the mountains. This was south of th eastern end of Cami: it reached the coast in the vicinity of Gable Islan in Beagle Channel. Here there was some contact with Yahgans, who, am convinced, conveyed hunting parties of Onas across to Navarin Island so that Onia may be said to extend south of Tierra del Fuego.

South of the Rio Grande the Onas, not counting the Haush, toda number perhaps a little over 800 people. These people in the early day spoke of the thickly peopled north and of the many men and their grea size. A fair estimate would place their numbers, including the wester Onas, at a little over 2,000, making a former total Ona population of pe haps slightly over 3,000.

Thirty years ago the Onas could undoubtedly be found in certai favored camping places in communities of a hundred or more. They ha approached nearer the clan stage than the Yahgans, giving greater recogn tion to certain men as leaders, a circumstance due to the fact that th northern part of their country permitted greater gregariousness and com munity life. However, after being driven south by the white man int

c forested mountainous regions food became more scarce and the hunt ore difficult. Of necessity they split up into subdivisions or family oups, so that today rarely more than thirty or forty individuals are und together, while frequently two or even single families are found ıssing a great part of their existence in pristine isolation.

FIG. 7—Map of Tierra del Fuego showing present approximate territorial clan divisions of the Ona ibe. Scale, 1:4,500,000.

The names are those of the recognized heads of the respective clans or family groups, and spaces ithin dotted lines represent the approximate location and area of hunting grounds occupied by the spective clans. The Haush territory is also shown, and the two mission stations are marked "Mixed." hat to the west is Dawson Island Mission, the other is the Salesian Mission just north of Rio Grande. t both stations are representatives of various clans, and at Dawson Island are representatives of the Ona, ahgan, and Alaculoof tribes. There are undoubtedly numerous territorial subdivisions which might be ıade, and the present divisions might be modified somewhat. Those of Tininisk and Aanikin occupy rritory on Navarin Island, where these clans overlap and trespass on adjoining territory, having been ushed south; they represent the southernmost limit of the Onas.

While, roughly speaking, the Onas north of the Rio Grande may be onsidered as northerns, those in the vicinity of Admiralty Sound and he south shores of Useless Bay as westerns, and those south of Rio Grande s southerns and the Haush as eastern Onas, yet many of these were inerrelated by marriage and were subdivided by themselves into groups ıamed according to their locality. Among the Onas each coast headland f every large lake has a name. The forest Onas of the south speak of the ıorthwesterns as *Parek u Chon* (camp men); the western Onas as *Kenenica*

Chon (western men); men from Cape Penas as *Joije u Chon;* men fro Lake Hyeuin as *Hyeuin u Chon.* The men in the mountainous forest region of Lake Cami they would speak of as *Cami u Chon* (Cami men) *Hische u Chon* (forest men), or *Gooiyin u Chon* (men of the mountains) but the clan of an Ona, Tapelt by name, from the head of the Rio Gran in the interior and north of Cami, was also *Gooiyin u Chon.*

The beach, or coast, Onas were *Coj u Chon* (men from the beach); me of Olte (vicinity of Cape San Pablo), *Olte u Chon;* extreme eastern pe ple, *Haush* or *Aush;* Yahgan men, *Wo-wun,* Yahgan women, *Aiila* Alaculoof, *Aiirru;* Ona, *Shilkenum;* civilized man, *Coliot,* or *Haliot,* o *Holist.*

Today these clans have been subdivided and to some extent redi tributed. The accompanying map (Fig. 7)[10] will give the approxima distribution by clan as it exists at the present time, the names in eac case being those of the headmen of the respective clans, while the follow ing is a list[11] of Ona names whose bearers more or less represent the var ous family groups:

Pechas	Oretush	Hochil
Conioth	Sha-chilen	Coshten
Doth'couken	Hilshoat	Hinikia
Tapelt	Haliminк	Sasiot
Tecolke	Aanikin (dead)	Halitas
Cauc'chemot	Tininisk	Tins
Cautemkel	Talikioat or Halimioat	Parren
Ishtōn	Caichina	!C yanin (*c* is clicked
Hechō	Chikioth	Doiyi
Kileheen	Minkoth	Met'e-ten
Dolal	Caucoat	Kel'kel'ke
!C woon (*c* is clicked)	Chalshoat	Hinkioth
!C ton (*c* is clicked)	Pupup	Yosi'alpe
Chor-che	Otrhshoal	
Ishiten	Aneikin	

The aggression of the white man has forced the Ona into the forest a mountain retreats of southern Tierra del Fuego. Thus his food supp (guanaco) is limited. This condition has naturally brought about feu and internecine strife. However, the curtailment of territory has broug about a more general distribution, with a jealous guard maintained by ea clan over its own area, and this contrariwise has made for a populati increase.

Hence, despite the fact that at the first touch of civilization the On were quickly reduced from about 3,000 to about 600, those who retreat unconquered into the southern mountainous country or had formerly c cupied part of it, even under the disadvantage of limited food supp

[10] Compiled with the kind assistance of Mr. Lucas Bridges.
[11] Compiled with the kind assistance of Mr. William Bridges.

ave slightly increased in the last few years. This very increase, how-
ver, but hastens the time when the food supply will be insufficient for the
emand, when the balance of nature between guanaco and Ona will be
pset. The guanaco are fast disappearing; then contact with the white
an will be the Ona's sole choice, and civilization will quickly get in its
eadly work.

At present the only necessary contact of this remnant with the white
an is with the Bridges brothers at their ranches on the east and south
oasts. To them the Argentine government and all who hold a true in-
erest in the Indian peoples owe a debt of gratitude for the toleration,
mpathy, and understanding shown in their dealings with the members
f the splendid tribe with whom they have come in touch.[12]

There is one dim hope for the Onas; it lies in the magnanimity of the
epublics of Chile and Argentina, particularly in that of the latter. The
rst step would be to set aside in perpetuity for the Onas' sole use at
ast the smaller and less desirable part of their birthright that has been
aken from them—say, all the territory of the island south of the line
f 53° 40′ 51″ S., except that occupied on Beagle Channel by settlers—
ith a mile-wide neutral strip north of it.

It was my privilege to bring this matter to the attention of the two
espective governments in 1908 and again to register my plea at the
econd Pan-American Congress held in Washington in 1916. As occa-
on demands, their territory should be restocked with young guanaco,
asily obtained from the pampas of the Patagonian mainland. Thus
ould justice, spiced with Christianity and common sense, be meted out
a splendid aboriginal tribe. Such a course would redound to the ever-
sting credit of Chile and Argentina, and thus would this tribe be pre-
erved before its little remnant takes up the last "great trek."

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[12] On Argentine interest in the native problem see the note entitled "Indian Reservations in Argen-
ia" in this number of the *Review*.

THE GEOGRAPHICAL WORK OF DR. M. A. VEEDER

By ELLSWORTH HUNTINGTON

In his "Elegy Written in a Country Churchyard" Gray mourns that

> Some mute inglorious Milton here may rest,
> Some Cromwell guiltless of his country's blood.

Today the poets and reformers seem to make their voices heard in alm every village. The careful, unostentatious scientist is the man most apt do his work unheralded and unrewarded. There is perhaps no great economic waste than that which condemns a man of great originality spend his time in the ordinary round of common duties rather than carrying on the so-called impractical investigations which are the essent foundation of all the so-called practical advances. Mendel was such a ma and his work on heredity was nearly lost because in his quiet, retired l the great biologist did not have the opportunity to make his influence fe How vastly poorer the world would be without his suggestive ideas, wh form the basis of eugenics and are destined to be one of the greatest fact in uplifting the human race!

Similar men have doubtless worked in other fields, and their ideas m still be waiting to be utilized. One such man has recently come to attention. I do not mean that he is another Mendel, for only time c determine that. I can say with confidence, however, that in the study meteorology I have come upon no writings which have stimulated me m than those of Dr. M. A. Veeder. His hypotheses may prove wrong, that will not destroy the stimulating character of his broad and origi ideas.

In January, 1916, Dr. Henryk Arctowski sent me a postal card adv ing me to read a certain article which he evidently thought important. few days later I went to the library. Before taking the card from pocket I looked up some other matters and came upon an article entit "Magnetic Storms and Sun Spots" by M. A. Veeder. It was a sin large sheet, the abstract of an article presented at the Springfield meeti of the American Association for the Advancement of Science in 1895. T brief text and especially the accompanying table were so interesting th I studied them for an hour, and determined to see what more I could fi by the same author. Then I took out the postal card and found that contained a reference to another article by the same man. Dr. Arctow and myself were so interested in these articles that we wrote to Dr. Veed at his home in Lyons, N. Y., but found that he had died shortly befo His family, however, sent us copies of his articles and later, at our requ

M. A. VEEDER, M.D.

Born at Ashtabula, Ohio, November 2, 1848; died at Lyons, N. Y., November 16, 1915.

a considerable number of his original tables, scientific letters, and unp lished articles. These proved so suggestive that parts of them are to published in this *Review.*

Dr. Major Albert Veeder was born at Ashtabula, Ohio, November 1848, and died at Lyons, N. Y., on November 16, 1915. He took his B. degree at Union College, Schenectady, in 1870 and later his M. A. 1878-79 he studied at Leipzig, and after a medical course at the Univers of Buffalo took his M. D. degree in 1883. He then practiced medicine Lyons, N. Y., the rest of his life. This modest, unassuming, but high gifted man should never have been obliged to get a living by practici medicine. He ought to have been connected with some great scienti institution where he would have been free to carry on his researches trammeled by anxiety about the support of his family. His mind w extraordinarily fertile in ideas, not only in respect to his own professi but along other scientific lines. He appears to have been the first to publi an article clearly setting forth the now well-accepted idea that typho germs are carried by flies, and it was upon his advice that the medic department of the United States Government adopted its successful poli of preventing the spread of typhoid fever in Cuba and in the southe camps of our soldiers during the Spanish War. He was also a pioneer advocating the open-air treatment of tuberculosis and was perhaps the fi adequately to explain it. In addition to such work Dr. Veeder was int ested in geology and wrote a number of articles about the mound build and about the rock structure and glaciation of his home district in weste New York.

Dr. Veeder's chief scientific interest, however, was in meteorology. the latter part of the seventies he began a study of the aurora. He n only made observations himself and utilized the reports of the Weath Bureau and similar organizations, but he also started a plan for c operative observations in all parts of the world. In connection with Pear polar expeditions, he distributed over 5,000 blanks to observers in all t continents, in order to have simultaneous records from as wide a region possible. It was always a pleasure to Dr. Veeder that people in many lan took such interest in recording and reporting auroras for him. The aurora studies led Dr. Veeder to consider the relation between the activiti of the sun and the earth. The result was that by 1895 he had framed a hypothesis which may possibly prove to be one of the most important co tributions not only to meteorology but to astronomy. Nevertheless, D Veeder's work has received little recognition. This is partly because h more important articles were published in journals having only the mo limited circulation. The nature of these journals made it impossible present the great body of facts which he had accumulated. So far as h work appeared in newspapers or more widely read magazines it took th form of conclusions without the facts on which they were based. Moreove

:. Veeder was unfortunate in not being able to arouse the interest of
her students of meteorology. In letters dating from 1886 to 1895 he again
d again urged the Weather Bureau to give his electro-solar hypothesis
trial. His efforts were fruitless. He was so far ahead of his time that
e scientific world was not yet ready for his hypothesis. Today, however,
e work of such men as Newcomb, Köppen, Hann, Bigelow, Arctowski,
ildebrandsson, Kullmer, and many others makes it clear that the time
ripe to test on a large scale every reasonable suggestion as to the con-
ection between solar and terrestrial activities.

Up to 1896 Dr. Veeder spent as much time on his researches as a busy
ysician's life would allow, averaging perhaps an hour or two a day.
rom 1893 to 1895 he devoted extra time to it, but then gave it up almost
itirely, although its problems fascinated him as much as ever. He was
ire that his conclusions were substantially correct and that the subject was
' the greatest interest and importance and far from being exhausted. He
as disappointed that his ideas were not more widely accepted, knowing as
e did their practical importance and wide application. Yet he realized
iat they would need time for recognition and he looked forward to their
eing carried on by others more favorably situated than was he.

As to giving up his researches he wrote on December 5, 1895: "If I could
mply have held my own professionally and financially, doing this work
s best I could at odd moments, I should have been satisfied. This has not
roved to be possible. Not being of independent means and leisure I feel
ompelled to discontinue. Of course, if I were to theorize or speculate
ather than sift evidence laboriously collected and collated it would be
asy, but the course I have been following depends upon work, and a good
eal of it, which I cannot continue, situated as I am." He found that his
iterest in these outside matters was used against him to injure him in
is medical practice.

The paper on "Magnetic Storms and Sun Spots," which first attracted
ny attention, was to be Dr. Veeder's valedictory, unless some way should
pen to give him the leisure and means to carry on his work. No such
vay opened, and he was compelled most reluctantly to relinquish it. It is
ne of the lamentable wastes of our American system that a man with such
musual originality and with a passion for the laborious, accurate study
of maps and figures should have been forced to give up the work that he
oved just at the time when he was capable of doing the most effective
service. It is truly astonishing to find how he has antedated more recent
workers in investigations and conclusions which they regard as among their
most important work. For instance, he fully appreciated Arctowski's
fruitful idea as to pleions, or waves of excessive heat, pressure, or moisture.
Dr. Veeder also saw clearly that storm tracks shift back and forth in lati-
tude in harmony with sun-spots, as has been shown more recently by Bige-
low, Hildebrandsson, Kullmer, and others. He also put into permanent

form my own idea that there are two kinds of solar variations, one therm and the other of some other nature. His conclusions as to auroras al antedated those of other investigators who have since confirmed his result

It is somewhat surprising to find that Dr. Veeder's most importa hypothesis was by no means the one with which his published writings de most fully. He apparently attached greater weight to his minute invest gations of auroras than to his general meteorological hypothesis.

In all his work Dr. Veeder insisted that ultimately its results woul be of great practical value. Nevertheless, he avoided a danger into whic many more recent investigators have fallen. He discouraged the idea th his conclusions would immediately result in a great change in our prese methods of forecasting the weather. He held that changes in the sun exe their effect chiefly by intensifying the pressure of anticyclonic area This in turn apparently strengthens cyclonic storms and causes their pat to vary. Unfortunately the terrestrial changes appear to take place at s short an interval after the solar changes that it is doubtful whether w can know what is happening on the sun in time to make predictions for t earth. If he is right, however, we shall at least know *why* changes c weather take place and why our weather predictions so often fail. Wha ever may be the ultimate fate of Dr. Veeder's hypothesis a careful stud of his writings cannot fail to be stimulating.

The work on the auroras is described in the articles listed below. H main hypothesis is explained on the following pages in an hitherto unpu lished article by Dr. Veeder, together with extracts from some of h letters. The main point of his hypothesis is that terrestrial weather dependent upon solar changes, to which he adds the conclusion that t relation is presumably electrical instead of thermal. So revolutionar an hypothesis needs an enormous amount of testing. Since becomin acquainted with Dr. Veeder's work I have attempted to begin this testin process. After making detailed comparisons between the solar chang and barometric gradients of over 2,500 individual days I have come to t conclusion that Dr. Veeder is essentially right in two important respect In the first place, solar changes appear to be closely followed by terrestri changes. In the second place, the connection between the solar and te restrial phenomena appears to be due in part to some cause other than hea

Like everyone whose ideas extend beyond those of their fellows D Veeder made mistakes. For example, he seems to ascribe undue impo tance to the *marginal* location of disturbances of the sun's photospher In this particular matter his earlier writings are apparently more corre than later ones. It is easy to see how his mistake arose. The appearanc of solar disturbances on the sun's margin when they are brought int sight by rotation is the most important agency in causing the activity o the visible portion of the sun's surface to vary from day to day. My ow investigations, however, show that changes in other parts are equally o

more important, provided they are of equal magnitude. In another respect Dr. Veeder perhaps went further than the facts warrant. He assumes that changes in the electrical field of the sun are sufficiently strong to produce the observed terrestrial changes in barometric pressure. Perhaps this is true, but it has not yet been demonstrated. It may be that the connection between the earth and the sun is due to some other cause not yet understood.

The value of Dr. Veeder's conclusions can be truly appreciated only when his methods are understood. As already indicated he made the mistake of giving too much space to his conclusions and too little to his facts. A study of his original tables and manuscripts, however, makes it clear that he rarely or never made a statement which is not based on a considerable body of evidence. His table of auroras, for instance, is a huge document perhaps twenty feet long and involving a vast amount of most assiduous labor. The way in which parts of it are recopied and marked in pencil shows what great pains he took in testing first one interval and then another to determine whether auroras really show a periodicity. He finally decided that the auroras show a periodicity of 27 days, 6 hours, and 40 minutes. The fact that he came to this conclusion without knowing that his result was within four minutes of the period of solar rotation determined independently on the basis of sun-spots is strong evidence of the reliability of his work.

Along other lines similar care is evident. The following extract from a letter dated July 26, 1895, gives an idea of the methods which finally led to the hypotheses presented on later pages of the *Review*. "I have two record books, one of which serves as a journal, and the other as a ledger. The pages of the journal are numbered with the ordinary calendar dates and likewise with the numbers of the days of the synodic rotation period of the sun. At the top of each page there is a diagram of the sun's disc upon which are noted the location of all spots and faculae seen. Upon the pages underneath are entered notes regarding thunderstorms, auroras, earth currents, and magnetic perturbations, together with as full an account as possible of any evidences of storm intensification or its absence. The other book, which serves as a ledger, is simply a very long-paged record book having many lines to the page. At the tops of the pages are placed the numbers of the days of the synodic rotation period of the sun in regular order from 1 to 28 [the 28th day being used only every fourth time] and underneath are placed summary references to what appeared at successive returns, so that it is possible at a glance to determine what conditions were present on any day of the period at many returns. By the use of such a system of tabulation of data it becomes possible to state the probabilities for a day or two in advance in reference to the behavior of the conditions shown upon the daily weather maps."

List of the More Important Articles by M. A. Veeder on the Relation between Solar and Terrestrial Meteorology

Solar Origin of the Aurora. *Sidereal Messenger,* November, 1889. 4 pp.

The Relation between Solar and Terrestrial Phenomena. Lyons, N. Y. 8 pp.

The Aurora. *Proc. Rochester Acad. of Science,* Vol. 1, pp. 19-25. 1889.

The Forces Concerned in the Development of Storms. *Proc. Rochester Acad. of Science,* Vol. 1, pp. 57-63. 1890.

The Zodiacal Light. *Proc. Rochester Acad. of Science,* Vol. 1, pp. 137-146. 1891. With table showing "Periodicity of Auroras."

Solar Electrical Energy Not Transmitted by Radiation. *Proc. Rochester Acad. of Science,* Vol. 2, pp. 245-254. 1892.

Thunder Storms. *Proc. Rochester Acad. of Science,* Vol. 2, pp. 134-148. 1893. With table showing "Periodicity of Auroras."

The Source of Solar Heat. *Trans. Astron. and Phys. Soc. of Toronto,* 1893.

Thunder Storms, Auroras, and Sun Spots. *Amer. Meteorol. Journ.,* Vol. 10, 1893, pp. 105-107.

Periodic and Non-Periodic Fluctuations in the Latitude of Storm Tracks. *Trans. Internatl. Congr. of Meteorol. at Chicago,* 1893. 7 pp.

An International Cipher Code for Correspondence respecting the Aurora and Related Regions. *Trans. Internatl. Congr. of Meteorol. at Chicago,* 1893.

Magnetic Storms and Sun Spots. Abstract of paper presented at Springfield meeting of the American Association for the Advancement of Science, 1895. 1 p., with table.

Sun Spots and Auroras. *Canadian Annual,* 1896, published as a supplement to the *Muskoka Herald,* Bracebridge, Ontario.

Magne-Crystallic Action and the Aurora. *Popular Astronomy,* No. 113 (March 1904). 3 pp.

The Relation between Sun Spots and Auroras. *Astronomy and Astrophysics,* No. 105

Solar Electro-Magnetic Induction. *Astronomy and Astrophysics,* No. 113, 1913.

The Relation between Solar and Terrestrial Meteorology

By M. A. VEEDER

Part I—The Observational Basis

(A) Introduction

By Ellsworth Huntington

Meteorology can never stand upon a firm basis until the perennial question of the relation between solar and terrestrial changes is settled. Where there is so much smoke it seems as if there must be some fire. Year by year there is apparently a growing tendency toward the belief that somehow changes in the sun's atmosphere are the direct cause of the changes in the earth's atmosphere which give rise to what we call weather. Most of the work along this line has been done within the past quarter of a century. Nevertheless, before that time a substantial beginning had been made. It is not improbable that some of the hypotheses proposed a generation ago may prove the key to our present problem. Among the

hypotheses offered in explanation of the elusive but seemingly genuine connection between the earth and the sun none is more carefully elaborated or more full of suggestions for future work than that of Dr. M. A. Veeder. Many of his results have never been published, and others have been published merely as conclusions without the abundant basis of observed facts on which they are founded.

The following pages contain portions of several articles and letters written by Dr. Veeder between 1888 and 1892, but hitherto unpublished. The reader will understand them better if he reads the preceding sketch of Dr. Veeder's career. The articles here printed are reproduced as they appear in Dr. Veeder's manuscripts, with no changes except that perhaps ten words are altered for clearness and certain portions which are now superseded or which are not directly concerned with meteorology have been omitted. Doubtless Dr. Veeder would write differently if he were doing his work today, but his facts still stand and his conclusions are worthy of careful study.

In order that the reader may have a background for the following articles he should bear in mind certain conclusions now generally accepted which were reached by Dr. Veeder independently before others had realized their importance. One of these is thus summed up in the Encyclopædia Britannica by Dr. Chree, director of the Kew Observatory: "That there is an intimate connection between aurora when visible in temperate latitudes and terrestrial magnetism is hardly open to doubt. A bright aurora visible over a large part of Europe seems always accompanied by a magnetic storm and earth currents, and the largest magnetic storms and the most conspicuous displays have occurred simultaneously." Although the cause of the secular variation of the earth's magnetic field is not yet understood, it appears certain that the range of diurnal inequality, that is, the temporary variations of the magnetic forces from hour to hour and minute to minute, bear an intimate relation to changes in solar activity as displayed in sun-spots. For auroras a similar relation prevails, as appears in Table I,

TABLE I—AURORAS AND SUN-SPOTS

Number of years	Sun-spot Numbers	Total Auroras	Average Number of Auroras per year in Scandinavia
(12)	0.0-6.8	350	29.9
(12)	7 0-11.3	700	59.8
(12)	12.2-16.6	738	61.5
(12)	17.1-28.1	765	63.8
(11)	30.0-36.8	812	73.8
(12)	37.3-45.0	983	81.9
(12)	45.0-54.2	995	82.9
(12)	54.8-66.5	1024	85.3
(12)	66.5-83.4	1279	106.6
(11)	84.8-101.7	1241	112.8
(12)	103.2-154.4	1390	115.8

which I have prepared on the basis of the figures given in the Encyclopædia Britannica for the years 1749 to 1877. These years have been divided into

groups of twelve (in two cases, eleven) years each on the basis of the sun-spot numbers for the year. For instance, the first group includes twelve years having sun-spot numbers ranging from 0 to 6.8. The next group contains the 12 years with the next higher spot numbers, from 7.0 to 11.3. The auroral data show the number of auroras seen in Scandinavia. An inspection of the table shows that as the sun-spot numbers increase, the auroras also increase. Individual years sometimes depart from this rule, but there is no departure when a considerable number of years are averaged. The departures are probably due to the fact that Scandinavia includes only an insignificant portion of the earth's surface and many auroras may occur without being visible there.

Another respect in which both terrestrial magnetism and auroras show a relation to the sun is in their daily period. I have prepared Table II

Table II—Diurnal Variation of Auroras and Terrestrial Magnetism

Hour	A Diurnal Inequality of Magnetic Declination in minutes of arc at six stations north of Latitude 40° N. (+=westward declination)	B Diurnal Inequality of Horizontal Force at six stations north of Latitude 40° N. (1=.00001 C. G. S.)	C Number of Auroras in November, December, and January in Latitude 71° N. and 78½° N.	D Number of Auroras from September to March in Latitudes 71° and 78½° N. and 70½° S.
1 A.M.	−12.8	−37	43	210
2	−16.2	−45	37	187
3	−21.0	−55	33	148
4	−23.1	−49	43	154
5	−24.8*	−33	41	124
6	−23.2	−22	33	77
7	−20.7	−14	27	60
8	−19.9	−28	13	26
9	−13.3	−51	18	36
10	− 7.0	−64*	15	30
11	+ 7.8	−44	15	30
12 Noon	+19.9	− 6	14	28
1 P.M.	+27.1	36	16	32
2	+29.2*	70	24	48
3	+24.7	95	42	84
4	+19.4	96*	49	102
5	+16.4	88	55	127
6	+15.9	63	61	151
7	+14.4	40	68	208
8	+12.9	21	67	255
9	+ 7.9	− 1	64	269
10	+ 1.1	− 7	61	263
11	− 5.6	−12	57	258
12 Midnight	−10.6	−26	42	210

to illustrate the matter, using figures given in articles in the Encyclopædia Britannica, but arranging them in a new way. Column A shows the average amount by which the *north* end of the magnetic needle is deflected from its usual position at six stations in the northern hemisphere at each hour of the day. A minus sign indicates a deflection to the east and a plus sign to the west. The eastward deflection is at a maximum not far from five o'clock in the morning. It slowly declines until ten, when a westward deflection begins. This reaches its maximum about two o'clock. The exact hours vary from station to station, but in the northern hemi-

sphere the maximum westward deflection regularly comes early in the afternoon. In the southern hemisphere similar diurnal variations take place, but there it is the southern end of the magnet which is deflected toward the west. In other words, in latitudes above 40° or 45°, where the magnetic forces are comparatively strong, the compass swings back and forth almost as if the centers of magnetic action shifted slightly westward when the sun is above the horizon and eastward when it sinks below.

Column B shows how the strength of the horizontal magnetic force varies at the same six stations. The force is well below normal until the sun almost reaches the zenith. Then it strengthens, reaching a maximum at three or four o'clock, but declines again at night. The diurnal change in both the direction of the compass and the strength of the magnetic forces can hardly be due to light or heat, for it is strongest in high latitudes, where heat and light vary least during the twenty-four hours. Moreover, although the change is stronger in summer than in winter, there are places such as Kew and Greenwich where there actually appears to be a secondary minimum at midsummer, just when the sun's heat and light ought to be most effective in producing a maximum.

In Table II columns C and D show the diurnal variation of auroras. The first column shows the figures for the months of November, December, and January, at Jan Mayen and Thornsden in high polar latitudes. Column D shows the auroras from September to March at these two sites and in south latitude 70½°, where the *Belgica* wintered in 1898. In both columns there is a marked diminution in the number of auroras in the morning. At first sight this might seem to be due entirely to the fact that even in these latitudes the winter sun when on the meridian is so little below the horizon that it slightly illumines the sky and thus renders auroras invisible. That the illumination of the sky has an important effect in diminishing the visibility of auroras is suggested by the fact that in column C the hours from 6 A. M. to 6 P. M. account for only 349 auroras, while the hours from 6 P. M. to 6 A. M. account for 589. In column D the contrast between night and day is still greater, 754 against 2,363. Nevertheless, as appears in Table III, some agency aside from light causes a great preponderance of auroras in the afternoon compared with the forenoon. For instance, taking the figures for northern auroras from November to January, as shown on the left of Table III, we see in the first line that one hour before noon, that is, at 11 A. M., 15 auroras were observed, and at one hour after noon, 16, a difference of 1, or 7 per cent, in favor of the afternoon. Comparing 10 A. M. and 2 P. M. we find 15 auroras in the morning against 24 in the afternoon, a difference of 9, or 60 per cent, yet the light at 10 A. M. is no brighter than at 2 P. M. All the way through the table the hours after noon up to midnight show an excess over the corresponding hours before noon having the same amount of light. The maximum difference comes about 4 o'clock. The same is true in the other part of the

Table III—Comparative Number of Auroras Before Noon and After Noon in High Latitudes

Number of Hours before or after Noon	Auroras in November, December, and January in Latitude 71° N. and 78½° N.				Auroras from September to March in Latitudes 71° and 78½° N. and 70½° S.			
	A Auroras before Noon	B Auroras after Noon	C Amount by which B exceeds A	D Percentage by which B exceeds C	A Auroras before Noon	B Auroras after Noon	C Amount by which B exceeds A	D Percentage by which B exceeds C
1	15	16	1	7	30	32	+ 2	7
2	15	24	9	60	30	48	+18	60
3	18	42	24	133	36	84	48	133
4	13	49	36	277*	26	102	76	292*
5	27	55	28	104	60	127	67	112
6	33	61	28	85	77	151	74	96
7	41	68	27	66	124	208	84	68
8	43	67	24	56	154	255	101	66
9	33	64	31	94	148	269	121	82
10	37	61	24	65	187	263	76	41
11	43	57	14	33	210	258	48	23

table, where both the northern and southern hemispheres are used, and th entire period of darkness from September to March is included. So fa as light and clouds are concerned there is no reason why the auroras shown in column B should be more numerous than in corresponding part of column A. Apparently the aurora-producing force is more effectiv in the afternoon than in the morning, just as are the magnetic forces show in Table II.

On the basis of the facts here stated and many others it seems probabl that both auroras and magnetic disturbances are due to the electrica activity of the sun, and that the solar force is at a maximum when th sun is on the meridian. The maxima of auroras and magnetic force, how ever, are delayed from two to four hours after the sun has passed th meridian either because the ions or other carriers of electro-magneti impulses travel more slowly than sunlight or because a certain amount o time is needed before they accumulate strength enough to display thei greatest effect. The earth, at each revolution, is apparently subjected t an electro-magnetic strain or stress due to its changing position in respec to the sun. The stress is, of course, extremely slight. Nevertheless Dr Veeder believed that it is sufficient to cause not only auroras and magneti disturbances, but certain other effects which are discussed below.

In addition to the conclusions already stated as to auroras and mag netism, Dr. Veeder came to certain others which are by no means so widel accepted. He held that the electrical action of the sun is confined t certain meridians. He based this conclusion not on a study of the sun itself, but on a study of the periodicity of auroras. Having tabulated th auroras for each day for about two hundred years, he found by repeate approximations that they show a periodicity of 27 days, 6 hours, and 4 minutes. His result, though obtained independently, agrees within fou

ninutes with the average period of solar rotation as determined by Maunder 'rom the study of sun-spots. Unfortunately Dr. Veeder published little of he details of his work. He did, however, publish an auroral table for the 'our years 1885 to 1888. From this I have prepared a periodogram covering 1,392 days divided into four nearly equal groups. It shows how the 'requency of auroras on each day differs from the frequency on the first, econd, and third days thereafter, and so on up to the 30th day after the lay in question. The results are shown in Table IV and also graphically in

TABLE IV—PERIODOGRAM OF AURORAS SHOWING THE SOLAR ROTATION CYCLE

—AURORAL DIFFERENCES—

GROUP	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16 Days*
I	110	142	160	168	150	152	152	119	116	107	121	123	141	146	159	157
II	126	136	129	140	142	154	167	177	169	181	195	186	199	187	159	191
III	128	144	165	178	170	157	151	150	154	151	137	143	140	141	174	182
IV	142	146	170	150	160	157	163	192	187	208	205	189	187	184	160	154
Average	127	142	156	159	156	155	158	160	157	162	165	160	167	165	163	171

	17	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*54*	*273 Days*
I	158	170	175	177	164	165	144	124	111	104	109	...	...	...	117	107
II	160	145	155	151	150	177	181	174	157	141	124	...	...	...	151	199
III	187	188	164	168	156	136	125	126	132	132	128	...	...	...	141	166
IV	154	148	151	151	173	175	186	201	191	176	174	...	...	...	170	187
Average	165	163	161	162	161	163	159	156	146	138	134	148	162	167	146	165

Figure 1. If the auroras occurred without periodicity, the difference between the number of auroras on a given day and on succeeding days would increase with lapse of time until it reached a certain average from

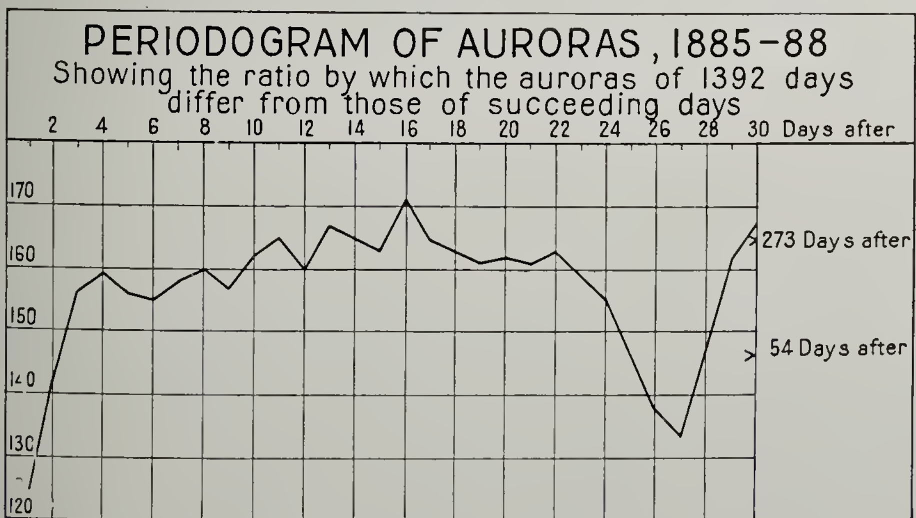

FIG. 1—Periodogram prepared from an auroral table by Dr. M. A. Veeder for the four years 1885-1888. The scale on the left is arbitrary; the arrowheads on the right indicate the height at which the curve would stand on the 54th and 273rd succeeding day (i. e. respectively at the end of two and ten solar rotations).

which there would be no important deviation. In other words, the curve of Figure 1 would at first rise rapidly and then gradually as it now does, and would at last become practically horizontal. Since each point in Figure 1 represents the average of nearly 1,400 individual cases, accidental

variations are reduced to negligible proportions. Accordingly the shar drop culminating on the 27th day can scarcely be the result of chanc There must be a real periodicity. It has not seemed worth while to car the periodogram beyond the 30th day, but as a further test I have con pared each day with the 54th succeeding it, that is, with the day comin at the end of two solar rotations, and also with the 273rd day, that is, th day at the end of ten rotations. The height at which the curve would stan on those days is indicated on the right of the diagram.

The meaning of Table IV and Figure 1 seems to be that during the fo years from 1885 to 1888 there was a decided tendency for the auror conditions of the earth to repeat themselves at an interval of 27¼ day corresponding to the period of the sun's rotation as seen from the eart At the end of two solar rotations this same tendency reappears, but in diminished form, while at the end of ten revolutions it has complete disappeared. This lends much probability to Veeder's conclusion th auroras and therefore presumably magnetic storms are connected wit certain definite areas of the sun's surface, which sometimes retain th power of exciting electrical disturbances for several rotations, but do n retain it so long as ten solar rotations. It should be clearly understoo however, that the solar periodicity in terrestrial phenomena is by no mea equally distinct at all times. It appears most unequivocally in perio such as 1885 to 1888 when there are comparatively few spots and especiall when they are largely confined to one side of the sun. When the sun highly disturbed the solar period is scarcely discernible either in auror or in other terrestrial phenomena. This is not surprising, for at such tim the sun's surface is in a constant state of agitation and a given conditio persists only a short time.

The next step in Veeder's investigations was an attempt to determi the position on the sun's disk in which the active areas produce the maximum effect. He identifies this position with the eastern margin the sun because he finds that on days when faculae or sun-spots appe there by rotation, auroras and magnetic disturbances are much more a to occur than on other days. In order to test this matter Veeder too the magnetic curves of the Naval Observatory at Washington for the 7 available days between February 2, 1889, and April 2, 1891, and measur the difference between the length of the pen trace showing the declinati and the corresponding horizontal time line. The difference between t two lines gives a good measure of the degree of disturbance. If the diffe ence is less than one-twentieth of an inch, the day is classed as qui Otherwise it is classed as disturbed, and the intensity of the disturban is reckoned in twentieths of an inch. Thus, although the scale is arbitrar a reliable figure for magnetic disturbance is obtained for each day. Mo modern methods of reaching the same result are of course better, but th makes no difference in our conclusions.

For the period covered by the magnetograph tracings Dr. Veeder took ıe standard "Results of Photographic Observations" on the sun, which ıclude data from Greenwich, India, and Mauritius, and from them made table showing all the days when either a sun-spot or a facula was brought ıto view on the eastern limb of the sun by rotation. Unfortunately after athering his data for both the sun and the magnetograph into a table hich embodies a great amount of work, Dr. Veeder did not discuss his esults at any length and did not analyze his table. I have analyzed it, ith the result shown in Table V.

TABLE V—MAGNETIC STORMS, SUN-SPOTS, AND FACULAE
Based on data compiled by M. A. Veeder

		A No New Solar Phenomena	B New Sun-spots	C New Faculae	D Ratio B/A	E Ratio C/A	F Ratio C/B
umber of days		533	94	156	....	....	....
ays with no magnetic disturbance	No.	331	37	52	....	....	....
	%	62%	39%	33%			
ays with magnetic disturbance	No.	202	57	104			
	%	38%	61%	67%	1.61	1.76	1 09
ays with magnetic disturbance of 7 or more	No.	65	18	40			
	%	12%	19%	26%	1.58	2.17	1.38
ays with magnetic disturbance of 11 or more	No.	45	11	25			
	%	8%	12%	16%	1.50	2.00	1.33
ays with magnetic disturbance of 21 or more	No.	18	6	10			
	%	3.4%	6.4%	6.4%	1.88	1.88	1.00
ays with magnetic disturbance of 31 or more	No.	6	3	6			
	%	1.1%	3.2%	3.8%	2 91	3.45	1.19

Column A shows the number of days on which no new solar phenomena, ither sun-spots or faculae, appeared on the sun's eastern limb as a result f being brought into view by that body's rotation. Column B includes he days when one or more new sun-spots appeared upon the sun's eastern imb, while C shows the days on which new faculae came into view. Folowing down the columns we see that on 62 per cent of the 533 days when o new solar phenomena appeared there were also no magnetic disturbances, ut this was true on only 39 per cent of the days when new sun-spots ppeared and on 33 per cent of the days when faculae appeared. In other vords, as appears in columns D, E, and F, the percentage of days with agnetic disturbances was more than one and one-half (1.6) times as great hen new sun-spots appeared as when none came into view and one and hree-quarters as great (1.76) when new faculae came into view. Days vith new sun-spots and new faculae are almost alike, but the faculae have slightly greater frequency of magnetic disturbances, as appears in olumn F.

In the succeeding lines of the table it appears that in both columns) and E the ratios increase in general until they reach a value of 2.91 and .45. This means that during the period in question violent magnetic dis-

turbances at Washington occurred twice as often when sun-spots especially faculae first appeared on the sun's eastern limb as on other day while the most violent of all were three or three and a half times as like to occur on such days as on days when no new solar phenomena we brought into view. Since the ratios in column F change but little, appears probable that sun-spots and faculae bear a similar relation to ma netic disturbances, but the relation of faculae is on the whole the closer the two. Perhaps the fact that faculae are not easily detected except the sun's margin may explain the discrepancies not only between t diurnal changes of the earth's magnetic field and the sun-spot curve, b between the Scandinavian auroras and sun-spots as explained in connecti with Table I. Faculae and sun-spots are closely related but do not ha exactly the same variations. If faculae could be detected as easily sun-spots the daily changes of the earth's magnetic elements might perha be found to agree almost exactly with changes in the sun.

On the basis of facts like those embodied in Table V Veeder conclud that magnetic and auroral disturbances on the earth depend largely up changes in the sun's electrical field due to the appearance of electrical disturbed portions of the sun's surface upon the earthward side by rotati He suggests that the outbreak of new disturbances or the increase of o ones upon the sun's earthward side may also produce an effect upon te restrial phenomena, but he does not carry this idea to its logical conclusi Hale has shown that "the magnetic fields of the sun-spots, which often rea intensities 50 times that of the sun's general field, are constantly cha ing in magnitude, as they are roughly proportional to the sun-spot areas Ions shot from such electrified areas would reach the earth in great numbers when the areas were on the part of the sun most directly faci the earth. Hence the breaking out of a new disturbance in the centi parts of the sun's visible disk would apparently influence the earth mo than would the coming into view of a similarly disturbed area by rotati Investigations which are not yet ready for publication seem to show that t is the case. Moreover, either the disappearance of a disturbed portion the sun's disk by rotation or the dying away of sun-spot activity on the pa of the sun's surface turned toward the earth would also be expected disturb the electrical equilibrium of the earth. Hence Veeder's resu would have been more convincing if he had investigated all changes kno to have occurred upon the sun's surface instead of restricting hims largely to those upon the sun's eastern limb. Nevertheless those on t eastern limb appear on the whole to be the most important because ro tion brings them suddenly into a position where they can at once influe the earth, whereas new spots commonly require some time in which develop. New spots, however, sometimes appear with great suddenne For example, Veeder cites an instance in 1881 when two photographs the sun taken on July 25 at 3.58 P. M. and 4.47 P. M. show that in 49 minu

here occurred an increase in spots amounting to 6,000,000,000 square miles, r about 3 per cent of the sun's total surface.

One more of Veeder's conclusions deserves emphasis. From a study of uroras he was led to believe that neither sun-spots nor faculae are in themelves the cause of terrestrial auroras and magnetic disturbances. He oted, as I have done in more recent cases, that sometimes when the sun is pparently quiescent without either spots or faculae the solar period in the rrestrial phenomena is peculiarly well marked. After two or three solar otations, however, spots and faculae are apt to appear in the longitude hich has apparently been producing the observed effects at each of its eappearances on the eastern margin. Hence Veeder believed that sunpots and faculae are a *result,* not a cause, and that in this they resemble uroras and magnetic disturbances. Both the solar and terrestrial results eem to arise from certain peculiar conditions of solar activity which have hus far not been detected except from their results.

(B) Storms and Solar Changes

By M. A. Veeder

[After Dr. Veeder had come to the conclusion that auroras and magnetic isturbances are due to changes in the sun and are connected with paricular parts of the sun's surface the next step was to see whether there is ny connection between the solar changes and terrestrial meteorology. To how his line of thought it seems worth while to quote at length from a letter a) and (b) and an unpublished article (c) in which Dr. Veeder gives a umber of details. During the period from 1886 to 1889 daily international harts—now unfortunately discontinued—were published, showing weather onditions throughout the northern hemisphere. These make it possible to ee at a glance what atmospheric activities were occurring in widely sepaated parts of the earth. The following pages give Dr. Veeder's comparison etween these atmospheric activities and changes in the condition of the un from October, 1886, to February, 1887, and in March, 1888. Similar etails might be repeated indefinitely, but what is here given is enough o show how abundant is the evidence which finally led Dr. Veeder to the ypothesis set forth in Part II of this article, to be published in the next umber of the *Review.*—E. H.]

(a) SOLAR AND TERRESTRIAL PHENOMENA OBSERVED FROM OCTOBER, 1886, TO FEBRUARY, 1887

From a letter addressed to Gen. A. W. Greely, Chief Signal Officer, U. S. A., and dated Lyons, N. Y., May 7, 1888.]

October 3, 1886. Many small groups of faculae appeared by rotation.

In North America the anticyclone (30.40) enlarged greatly, the North Pacific Coast yclone deepened (29.79 to 29.65), a small low (30.00) moved eastward. On the tlantic coast the winds increased in force.

On the Atlantic Ocean. The cyclones between Newfoundland and Great Britain

were crowded together by enlargement of the surrounding anticyclones and were parti filled up (29.60 to 29.80 and 29.19 to 29.42). A severe storm not shown on the preced ing map appeared off the coast of Norway, pressure 29.13.

In Europe. The anticyclone (30.40) enlarged greatly.

In Asia. A low, circumscribed by isobar 29.60, appeared. The Siberian anticyclon was crowded eastward and weakened (30.40 to 30.20). The Indian cyclone 29.60 w enlarged. Evidence of the formation of a low over the East Indies became apparen the low itself coming fully into view on the charts for October 4 and 5.

The general effect of these changes may be summarized as an increase of barometri range as compared with the day preceding—anticyclones in general having bee strengthened and cyclones likewise on the whole having increased.

October 6. An outbreak of spots occurred in the area of faculae which came int view October 3, also several groups of faculae appeared by rotation.

In North America. The North Pacific Coast low deepened (29.72 to 29.46). A lo with isobar 29.80 appeared over southern California. The anticyclones remaine steady.

On the Atlantic. Low (29.80) appeared over Gulf Stream with strong winds i that vicinity. Low over North Atlantic enlarged somewhat and deepened greatl (29.31 to 29.12). Anticyclone over South Atlantic [i. e. southern North Atlantic] stead but moved eastward.

In Europe. Anticyclone (30.20) diminished in size.

In Asia. Cyclone in western part deepened slightly (29.33 to 29.26). The ant cyclone enlarged greatly and deepened (30.00 to 30.20). Severe storm with pressu 29.14 appeared off the Pacific coast.

In this case again the barometric range is increased by the formation of new lov and increase in depth of those already existing. The anticyclones, however, remai comparatively steady, the only well-marked increase being in Asia. These conditio persist very steadily until the next date.

October 9. A group of faculae appeared, and there were rapid changes in th group of spots near the sun's meridian.

In North America. The Pacific Coast low (29.80) moved into the Rocky Mounta region and deepened (29.80 to 29.60, Oct. 10). Storm with isobars 29.60 appeared ove the Gulf of Mexico. New anticyclone 30.20 appeared in the Northwest. Gulf Strea storm 29.80 filled up by increase of eastern anticyclone (30.20).

On the Atlantic. Anticyclone (30.20) enlarged greatly. North Atlantic stor became more severe (29.20 to 28.80).

In Europe. Anticyclone 30.40 enlarged and moved eastward, filling up the cyclo over western Asia.

In Asia. The Siberian anticyclone enlarged and increased (30.20 to 30.60 on Oc 10). On October 10 the cyclone off the coast of Asia deepened (29.80 to 29.60), an the anticyclone moved eastward, making the gradient very steep.

Again there is an increase of barometric range, cyclones and anticyclones general throughout the northern hemisphere showing coincident sudden changes of like characte

October 14. An outbreak of spots of considerable size occurred near the sun meridian.

In North America. A storm of great severity suddenly developed (29.60 to 29.10 The eastern anticyclone increased (30.00 to 30.20). The western anticyclone remain steady.

On the Atlantic. North Atlantic cyclones underwent rapid changes, a very seve storm (28.65) apparently forming west of Ireland. Another low, 29.57, appears in th South Atlantic. The South Atlantic anticyclone enlarged somewhat.

In Europe. The anticyclone 30.20 moved eastward, increasing in area. A low, econdary to the North Atlantic storm, formed with isobar 29.80 on October 15.

In Asia. The Siberian anticyclone deepened (30.20 to 30.40). The storms attending his outbreak upon the sun were very remarkable in many respects.

October 16. The spot group that formed on October 14 underwent rapid changes, nany spots forming in two groups.

In North America. The anticyclone enlarged and increased in depth (30.40 to 0.60). The cyclone deepened from 29.42 to 29.29.

On the Atlantic. The anticyclone enlarged in area and increased in depth (30.20 o 30.60).

In Europe. The cyclone central over Great Britain remained steady (28.68 to 8.69).

In Asia. The western anticyclone (30.40) and the eastern anticyclone (30.20) nited, forming one very large anticyclone with isobar of 30.60 at center.

October 23 and 24. Two small spots and a group of faculae came into view by otation.

In North America. Low formed on North Pacific coast (29.58 on Oct. 25). Low ormed east of Rocky Mountains (29.49 on Oct. 23). Two anticyclones formed (30.20 n Oct. 23) and deepened (30.40 on Oct. 24), uniting into one on October 25 (30.60).

On the Atlantic. Cyclone near Newfoundland deepened (29.80 to 29.56 on Oct. 23). Vest Indian cyclone deepened (29.80 to 29.50 on Oct. 23). Anticyclone (30.20) emained steady.

In Europe. Cyclone over Spain (29.66) remained steady until October 25. Cyclone ormed north of Norway (29.71 on Oct. 25). Two anticyclones formed and increased 30.40 to 30.60).

In Asia. Siberian anticyclone increased (30.20 to 30.40) and moved eastward, ollowed by small cyclone (29.80) on October 23. The conditions thus established emained pretty steady until the next date.

October 30. Faculae came into view by rotation.

In North America. Anticyclone (30.20) enlarged. North Pacific coast cyclone ncreased in size, moving southeast. Cyclone (29.76 on Oct. 31) formed over Middle Atlantic coast.

On the Atlantic. North Atlantic low deepened (29.70 to 29.15). The anticyclone nlarged and deepened (30.20 to 30.40).

In Europe. The anticyclone diminished somewhat in depth and increased slightly n area (30.80 to 30.60).

In Asia. The cyclone increased slightly in depth (29.63 to 29.47) and moved eastvard. The Siberian anticyclone diminished somewhat in depth (30.60 to 30.40) but ncreased in area.

It happened that observation was poor on October 29. It is possible that portions of the solar disturbance of October 30 were in view then.

During November, 1886, there was a well-marked period of sun-spot minimum. Hence this month is specially interesting. Auroras were numerous during the first week. Although but one solar disturbance, a group of faculae on the 4th was observed coming nto view by rotation.

November 4. A group of faculae of small extent appeared by rotation.

The anticyclones generally increased in extent and depth, and the cyclones were but ittle affected.

November 7. A group of faculae was observed close to the sun's eastern margin.

A severe storm (29.03) formed over the eastern United States, and the Atlantic anticyclone enlarged somewhat. Otherwise the conditions did not change materially.

On November 8 and 9 also small groups of faculae appeared by rotation. The

changes in barometric pressure were, however, relatively unimportant. The compa tive evenness of barometric pressure throughout the northern hemisphere, particula on November 11, is noteworthy. There was not entire calm—but both sun and atm phere were remarkably quiescent, and that, too, at a time when storms are usua most severe. This quietude was soon broken in upon, however.

November 13 and 14. Very bright faculae appeared upon the sun's margin rotation.

In North America. The anticyclone enlarged and increased (30.40 to 30.60). severe storm (29.41) formed on the South Atlantic coast and deepened to 29.14 November 15.

On the Atlantic. The cyclone near Great Britain deepened from 29.45 on Novemb 12 to 29.11 on November 15. The anticyclone remained steady. The Siberian an cyclone remained nearly steady.

In Europe. A low (29.40 on Nov. 14) formed, secondary to the Atlantic cyclone.

November 16. Several spots formed in the group of faculae that came into vi November 13 and 14.

In North America the western cyclone from Lower California advanced rapid eastward, with pressure at the center as low as 29.10 on November 19. In the Chi seas also a storm (29.48) developed. There were some changes in the anticyclones ov the United States and the Atlantic, otherwise the conditions remained but little change

From November 21 until November 29 there was another period of great quietu on the sun. Throughout the northern hemisphere during this period atmospheric pr sure was very evenly distributed. The only storm of importance noted moved fro the Pacific coast on November 20 and passed rapidly across the United States, wi quite low pressure at the center (29.10 on Nov. 23), following almost the precise tra of the storm of the week before. Several instances of storms succeeding one anoth in the same track at short intervals have been recorded. The evenness of distributi of barometric pressure, particularly on November 27 and 28, is noteworthy. All t storms previously running had almost exhausted themselves. On November 29, howev a fresh impulse of some sort was given, the faculae of November 4 returning by rotatio

November 29. Faculae came into view by rotation.

In North America. The cyclone deepened (29.74 to 29.39).

In Europe and on the Atlantic. The anticyclone developed largely in extent, a the storm near Norway became severe, pressure falling from 29.30 on November 28 28.74 on November 30.

December 1, 2, 3, and 4. No observation.

December 5 and 6. A group of faculae appeared by rotation.

In North America. The anticyclone divided, and a low (29.80) formed over Sou Atlantic coast.

On the Atlantic. The cyclone deepened (29.00 to 28.56 on Dec. 7). The ant cyclone changed but little.

In Europe. Little change noted.

In Asia. Anticyclone fluctuated somewhat.

December 8 and 9. Faculae and spot appeared by rotation.

In North America. North Pacific low remained steady (29.21). The anticyclo (30.40) enlarged.

On the Atlantic. The low over the Gulf Stream moved northward, increasing depth, 29.53 on December 8, 28.80 on December 10. The low over Great Britain dee ened (28.56 to 28.02). The anticyclone over the South Atlantic remained steady.

In Europe. Cyclone deepened. Otherwise no marked change.

In Asia. Cyclone on Pacific coast deepened (29.80 to 29.40). Otherwise no marke change.

There were many changes in the spot group that appeared on December 8 and 9 during its entire transit. It disappeared on December 19, leaving the sun very tranquil.

On December 20 the comparative evenness of distribution of atmospheric pressure is again noticeable. It did not last long, however.

December 21. A small spot, the first of an extensive group, appeared by rotation. Atmospheric pressure remained quite steady except in the North Atlantic, where the low deepened from 29.51 to 28.93.

December 24. A group of spots, one very large, appeared by rotation.

In North America. A low formed in the Great Lakes region (29.80 to 29.40 on Dec. 25). Anticyclone (30.40) enlarged.

On the Atlantic. Low deepened from 29.40 on December 23 to 28.93 on December 25. Secondary low, 29.80, also formed in South Atlantic.

In Europe. A low, 29.51, and a low, 29.80, formed secondary to the Atlantic depression.

In Asia. The Siberian anticyclone enlarged.

During its entire transit this group of spots underwent numerous changes which it would be tedious to follow in detail. Another spot also came into view on December 27. On the basis of the hypothesis here under consideration the last week of December and the first days of January should have been a period of severe storms; which was the case. The barometric range on December 31 was remarkable, the North American anticyclone attaining 31.00 and the North American cyclone, 28.80.

January 5, 1887. Considerable faculae appeared by rotation.

The most notable coincident change was the deepening of the North Atlantic cyclone from 29.00 to 28.46, the isobars becoming numerous and crowded. A low (29.63) formed off the South Atlantic coast of the United States and another low (29.52) on the Pacific coast of Siberia.

On January 6 and 7 other groups of faculae came into view. Coincidently the anticyclones generally were strengthened.

No satisfactory observations were had until January 15, when the sun was found to be comparatively clear, groups of faculae alone being detected in the western quadrant.

January 17. Faculae were observed coming into view by rotation.

In North America. The North Pacific coast cyclone deepened from 29.82 to 29.29. Another low moved rapidly eastward, increasing in depth from 29.51 to 29.16 (28.93 on Jan. 18). The anticyclone increased from 30.40 to 30.60.

On the Atlantic. North Atlantic low deepened from 29.00 to 28.40, isobars becoming numerous and crowded. A secondary low (29.35) formed east of Newfoundland. The anticyclone increased in size and depth (30.20 to 30.40).

In Europe and Asia. The conditions were not materially changed.

January 20. Considerable faculae observed close to sun's eastern limb.

In North America. North Pacific low 28.85 (was 29.27 Jan. 19). Eastern low moved rapidly toward Gulf of St. Lawrence and deepened (29.08 on Jan. 21).

On the Atlantic. North Atlantic cyclone deepened, becoming 28.69 on January 21 (had been 29.35 on Jan. 19). Isobars became very numerous and much crowded.

January 24. Large and very active spot group, which underwent numerous changes during its entire transit, came into view on January 24 and 25. From January 24 to February 5 storms were severe. On January 28 and 29 the barometer registered 28.60 in the North Atlantic and likewise again on February 2. On February 3, 4, and 5 the barometer attained 31.00 over British America.

February 2. A group of active spots came into view by rotation. The cyclone over the North Atlantic became more intense, the isobars more crowded, and the pressure lower (28.54). On February 3 coincidently pressure had risen to 31.00, and on February 4 it attained the remarkable height of 31.20.

On account of cloudiness the observation of faculae became difficult, and there were few spots visible until February 17, hence details cannot be given for this period.

February 17, 18, and 19. A group of large spots appeared by rotation.

Cyclone moved rapidly eastward in the United States, deepening from 29.60 to 29.03.

The North Atlantic cyclone deepened from 29.39 to 28.84, and the isobars became numerous and crowded. In southeastern Europe a low (29.62) formed. The cyclone east of Siberia was deepened also (30.00 to 29.80).

(b) CONCLUSIONS

In general it may be remarked that in October the disturbances were quite evenly distributed on all sides of the sun. At certain intervals however, well-defined impulses affecting the atmosphere very strongly over wide areas were imparted. In November there were two well-marked periods of quietude both in the sun and coincidently in the atmosphere. In December, January, and February there were two extensive areas on opposite sides of the sun that were actively disturbed. It was only for brief intervals that one or the other of these was not upon the earthward side of the sun, and storms were almost incessant. At certain times periods of well-marked increase occurred. In March, during the first half of the month, there was active disturbance, but it was ill-defined and difficult to trace. During the last half of the month the conditions were more easy of observation, several well-marked impulses being imparted to the atmosphere coincidently with characteristic solar conditions.

In short, it is the phenomenon known as the atmospheric "surge"[1] that seems to bear the closest relation to the varying condition of the sun. The rapid fluctuations of barometric pressure, sometimes remaining stationary for days in a single locality, resemble aërial tides and do not appear to be traceable to any well-defined terrestrial cause. They occur where aqueous vapor is abundant and where it is lacking. Not infrequently they are apparent during the same day throughout the entire area covered by observations. There must be some cause for them affecting the entire earth. A close examination of the record of solar conditions after the manner that has been suggested will, it seems to me, afford a key to this, one of the most difficult problems connected with meteorology.

From the above summary it appears that whenever active changes are in progress upon the sun the range of barometric pressure increases, temperature and pressure gradients become more steep, and in short all the phenomena attending storms become more intense. It is not possible, however, to use the information thus secured for purposes of weather prediction further than to note the fact that a period of severe storms may be at hand, their locality being impossible to determine save imperfectly by means of the synoptic charts.

As regards the solar observations certain points must be noted. It is

[1] Arctowski's "pleions."—E. H.

ie brightness and extent of the faculae rather than the dark spots that ust be taken into account in forming an opinion in regard to the activity f a solar disturbance. It may be noted also that for months together isturbances upon certain parts of the sun are more energetic, being ttended by auroras or magnetic and electrical phenomena to a far greater xtent than those located elsewhere. It is only by keeping a careful record uring successive periods of the sun's revolution on his axis that this eature can be made manifest. At times for months together it may afford ie means of forecasting periods during which storms will occur of eculiar intensity.

It is to be understood that these solar impulses constitute but one lement in the problem. The influence of climate and season in different arts of the earth causes different effects to follow from the same impulse ı different localities.

I have given but one phase of the subject in this summary. The proof ight be greatly strengthened by taking into account the subject of uroras, magnetic storms, and thunderstorms, which have been the topic f previous communications.

As regards the nexus, or bond of union, between these special solar and tmospheric conditions, it is difficult at present to state any hypothesis that vould not perhaps be soon overturned by a further study of the facts. It s not yet time to theorize, but much, it seems to me, may be hoped to be earned by collecting facts along the lines that have been indicated in the oregoing hasty outline, which has been brought together very imperfectly ıt intervals in the midst of other duties.

c) THE NEW YORK BLIZZARD AND ITS ATTENDANT CONDITIONS FROM MARCH 6 TO MARCH 15, 1888

The study of a well-marked period like that during which the New York blizzard occurred may be expected to yield interesting results.

The Solar Conditions. On March 7 a disturbed area which contained ı small spot on March 9 came into view by rotation. On March 9 another group of several spots appeared. The faculae in their vicinity presented a glowing and rose-tinted appearance and underwent rapid changes. These disturbances were visible until March 20, no other of any importance appearing except on March 15.

Auroras and Thunderstorms. On March 7 auroras were seen in Dakota, Iowa, Massachusetts, Michigan, Minnesota, New Jersey, and Wisconsin, being especially brilliant in northern Michigan. No thunderstorms were reported. Upon subsequent dates they were faint and rarely seen, until March 15, when they again became widely prevalent, on that date also no thunderstorms being reported. On March 9, when spots appeared as above, thunderstorms became widely prevalent at numerous points

throughout the southern United States, extending within forty-eight hours from California on the west to Florida on the east, faint auroras only being reported at one or two stations in the Northwest.

This reciprocal relation between thunderstorms and auroras has been noted in well-marked instances repeatedly. It may serve to explain why in certain instances the magnets remain quiet when large solar disturbances appear, atmospheric taking the place of earth currents.

It is noteworthy also that the outbreak in each instance followed at once upon the appearance of the solar disturbance by rotation. It is very remarkable that the aurora should reach its height within a single day and then decline, although the solar disturbance originating it remains upon the earthward side of the sun for nearly two weeks. The same is true also of disturbances of magnetic declination. It may be noted in general that auroras and magnetic disturbances appear before the solar disturbance coincident with them has reached the sun's meridian. A brilliant group of faculae, especially if it have a glowing rosy tinge, is more likely to be attended by magnetic or electrical phenomena than is a single dark spot having a typical form and penumbra. The most active disturbance of all is the rifted and broken collection of small spots with brilliant faculae in their vicinity, which was the character of the disturbance of March 9.

Magnetic Conditions. On March 6 the magnet at Washington was almost perfectly quiet. On March 7 very active movements began and, as is usual, were most pronounced during the night. The force that produces auroras and magnetic storms appears to be repulsive, producing these effects upon the darkened side of the earth away from the sun. Perhaps it will be found that thunderstorms prevail upon the side of the earth toward the sun under such circumstances, the full force of the variation of tension being limited to a few hours only and declining rapidly after the first impulse. A period of thunderstorms as well as auroras is usually brief. The effects of sustained tension would probably be cognizable under some different form of manifestation from those due to rapid variation of tension.

It is noteworthy that the magnet at Los Angeles was put in motion on March 7 at precisely the same instant as those at Toronto and Washington. But the movements were less vigorous, as appears to be the rule in that locality.

Earthquakes. Earthquake shocks were felt at 8 A. M. at Pasadena, Cal., on March 7; in Herzegovina on March 8, and in Norway at 2 A. M. on March 12. Earthquakes as a rule become more frequent during the periods when auroras and magnetic storms are prevalent.

Atmospheric Movements. Following the period of thunderstorms and auroras there appears to be a period when secondary phenomena due perhaps to sustained tension increase. It is at this time that anticyclones become most prevalent. In any event the period under consideration will

be found very interesting because of the remarkable atmospheric conditions everywhere prevalent during its continuance.

At 7 A. M. on March 7 in the United States the atmosphere was very quiet, there were no strong winds, and the isobars were far apart and few in number. On March 8 a decided change had become apparent, isobars and isotherms becoming more and more numerous and crowded, culminating on March 11 in the famous New York blizzard, which appeared totally unannounced.

That this blizzard was not a local affair but formed a part of a world-wide disturbance is shown by the fact that upon the same day a storm fell upon England totally unannounced by the Weather Department. The violence of this storm may be estimated by such facts as the following: At Pembroke, England, the barometer fell to 28.57. At 5 P. M. at Greenwich wind pressure rose to 31 pounds to the square foot, equal to a velocity of 80 miles an hour. At Rousdon Observatory, Lyme-Regis, a Robinson standard cup anemometer recorded the following velocities: 64 miles from 11 A. M. to 12 M.; 67 miles from 12 M. to 1 P. M.; 71 miles from 1 to 2 P. M.; 73 miles from 2 to 3 P. M.; 63 miles from 3 to 4 P. M.

On March 12, 13, and 14 a storm appeared upon the Pacific coast of the United States with wind velocities from 50 to 60 miles an hour at Ft. Canby, Washington Territory.

On March 10 also the wind rose to 50 miles an hour at Galveston, Texas.

On March 9 a storm that left Newfoundland on March 1 experienced a marked increase of energy, the barometer falling very low, with force of wind 12.

On March 13 in western Australia the barometer suddenly fell 0.20 inch in a cyclonic area moving eastward along the south coast. On that date also a tidal wave reached New Guinea and New Britain. At the latter place it is supposed to have risen 40 feet. On March 15 the wind attained a velocity of 55 miles at Sydney, Australia. On Lake George in that country the observer remained windbound for several days.

Other details might be given showing the violence and extent of the atmospheric commotion in many localities throughout the earth at the time of the New York blizzard. It is a curious fact that this storm revived again on March 15, it having moved eastward with decreasing force after having devastated New York and vicinity. It will be observed that March 15 was the date of the appearance of another outbreak upon the sun, attended by auroras and magnetic storms. It is stated also that there was a revival in the energy of a storm lingering in Scotland on that date also.

It is by continued study of the natural grouping and association of phenomena, particularly during such periods as that in question, that we may hope to gain an insight into their true relations. My purpose in this hasty sketch is to illustrate the method rather than to justify conclusions.

(To be concluded)

ASKJA, A VOLCANO IN THE INTERIOR OF ICELAND

By W. S. C. RUSSELL

Nowhere else in the world are the two extremes of fire and ice s intimately associated as in Iceland. Volcanic rocks form the greater pa of its area; many of these are recent lavas which have been poured fort by its active volcanoes. The higher portions of the island are covere by large ice-fields, great flat carapaces similar to the ice-cap under whic Greenland lies buried. The largest of these, the Vatna Jökull, is three time the size of Rhode Island. In some cases an active volcano projects abov the ice-cap. When an eruption takes place under these circumstance the effect is catastrophic. The red-hot lava, falling on the ice, causes i to melt suddenly, and a torrent of steaming water, mud, rocks, and piece of ice is precipitated down the slopes into the valleys below.

Although Hecla is Iceland's best-known volcano, there are many other that deserve attention. Possibly the most interesting of these is Askja an immense crater in the east-central section of the island. In 1913 th writer, in company with J. C. Angus of York, England, went to Icelan to attempt two things: first, to examine the crater of Askja; and, second to cross the Sprengisandr, the desolate sand and gravel waste which extend in a northeast-southwest direction as a long band across the interior, fro Svartárvatn (Black Lake), the starting point for Askja, to Eystri Polla a point north of Hofs Jökull, the most centrally located ice-field of th island, thence through the Illvidrahnúkar (Bad Weather Peaks), along it northern edge, and finally along its western rim southwest cross-country t Reykyavik, the capital. Both objects were successfully accomplished. Thi paper deals only with our examination of Askja.

Even in Iceland Askja was relatively unknown until 1875, when, o January 4, a tremendous eruption occurred, accompanied by a series o violent earthquakes and great showers of ashes and pumice, which covere a wide extent of country. In February Jón of Vidkaer and another nativ visited the volcano, which was still in eruption, and ascended the crate rim from the northwest by a pass now called Jónskard. In July an Eng lishman, W. L. Watts, visited the region from the south.[1] In the summe of 1876 a Danish expedition under the geologist Professor F. Johnstru made the first scientific examination of the region.[2] On this occasion Lieu tenant Caroe of the Danish Navy made a survey of the crater. W. G. Lock

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[1] Journey across the Vatna Jökull in the Summer of 1875, *Journ. Royal Geogr. Soc.*, Vol. 46, 1876, pp. 1-10.

[2] Om dei Aaret 1875 forefaldne vulkanske Udbrud paa Island, tilligemed nogle indledende geografisk Bemaerkniger, *Geografisk Tidskrift*, Vol. 1, 1877, pp. 50-66.

ı Englishman, visited Askja in 1878 and 1880 and published two accounts.[3] . Delmar Morgan, F.R.G.S., in company with Jón of Vidkaer, entered the ater in 1881. He likewise published two accounts of his trip.[4] In recent ·ars the crater has been visited several times by German scientists, prinpally by Dr. Hans Spethmann and Heinrich Erkes, in 1907 and 1910 by e former and in 1908 and 1910 by the latter. They have published nuerous accounts.[5] The work of Erkes was largely confined to an exploration the Trölladyngja, an ice-capped volcano southwest of Askja, but he otained some excellent photographs of the shore of Askja's crater lake, nebelsvatn. He named the lake "Knebelsee" in honor of von Knebel, who, company with Rudloff, lost his life in the lake in 1907.[6] The Icelandic rmination *vatn* is preferable.

Extending north, west, and south of Askja lies a large lava-field, the dádahraun, or "Evil-Deed Lava." It is so named because of the havoc rought in the valleys and the extensive plains which the lava from skja has penetrated. These lava sheets lie at an altitude of about 1,500 et and consist of numberless lava flows, some of them thousands of years d, clothed with lichen, while others are of recent origin. The great va fields of the Dýngjufjöll (Bower Mountains) on the north have flowed om rifts which have opened again and again in the mountain wall that rcles Askja and forms the real crater rim.

The lava areas to the south and southwest of Askja, according to Watts, ıme from the craters of the Tröllandyngja, and Erkes in his report is clined to support the statement of Watts. The writer, however, is of the ›inion that the lava, covering hundreds of square miles in this section of eland, comes principally from Askja. Doubtless, in early times, before ıe base of Askja was buttressed as it is today by the overflowed lava, equent eruptions occurred in the outlying ridges, which give evidence of e tremendous rifting in bygone years.

It is impossible to depict the utter desolation, the terrible tangle of iffened lava billows, the crumpled ridges and blister eaves that extend r miles in all directions from Askja. It is as if the lava, as liquid as the a and rolling in mighty waves whose crests were slashed by winds of ırricane velocity, had, when in this condition, immediately solidified on ıe surface. Following this the pent-up gases, combined with the intense

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[3] Askja, Iceland's Largest Volcano, With a Description of the Great Lava Desert in the Interior and a Chapter on the Genesis of the Island, Charlton (Kent), 1881.

Askja, The Largest Volcano of Iceland, With a Short Description of the Ódáðahraun, *Proc. Royal Geogr. Soc.*, Vol. 3, 1881, pp. 471-483.

[4] Excursion to Askja, August,1881, *Proc. Royal Geogr. Soc.*, Vol. 4, 1882, pp. 140-146.

Chapter IV in J. Coles' "Summer Travelling in Iceland," London, 1882.

[5] See principally H. Spethmann: Islands grösster Vulkan, die Dyngjufjöll mit der Askja, Leipzig, 1913 (with bibliography, pp. 23-25).

H. Erkes: Meine vierte Islandreise, Sommer, 1910, *Globus*, Vol. 98, 1910, pp. 309-311.

[6] See especially "Island: Eine naturwissenschaftliche Studie," a posthumous work of von Knebel, npleted and edited by Dr. Hans Reck, Stuttgart, 1912, reference on pp. 198-200; also Spethmann, *op. cit.*, . 12-20.

ıbheat, burst the thin crust in myriads of places with secondary out- ɔurings. It is a chaos beyond the description of the wildest imagination. 'ere and there great depressions, like mammoth bowls, occur; again ·emendous blisters heaved up by internal pressure cover the area. Subse- ıent shrinkage and cracking have transformed many of the domes into eird caves, places where witches hung their devil's cauldron and brewed ıeir fiendish potions. But the pots are ruined and only the crumpled ıd contorted fragments are left to ensnare the feet of the orthodox 'aveler.

We arrived at Svartárvatn (Black Lake) on July 13, 1913, and imme- iately repacked our cases, taking only such instruments and supplies as ere necessary for the expedition. The farmer Thordur Floventsson ccompanied us to act as guide across the intervening lava. We left the ırm at noon of the same day and followed the Sudrá about four miles › its springs at the edge of the Ódádahraun. This water undoubtedly ows for a long distance under the lava, coming down from the melting ıows of the upper slopes of the Dýngjufjöll. The entrance to the lava ıeet is abrupt, and the line between the volcanic ashes and lava is nearly raight for several miles. Hour after hour we picked our toilsome way ver horrent and bristling ridges, now descending into the valleys, where ıe ashes treacherously concealed the cracks and blisters in the lava sheets; gain climbing by painful steps to the summit of the ridges only to see eyond us the snow slopes of the Bower Mountains, apparently no nearer ıan an hour before. We emerged from the lava as abruptly as we entered and came upon ridges of wind-driven volcanic ashes, arranged in heaps ke the great wastes of the Sahara, but, unlike the Sahara, capped with ıow. The vast hollows were filled with ponds and the ravines echoed 'ith boisterous torrents.

We rested an hour in the shelter of an ash hill to partake of our evening ıeal and feed the ponies with hay which we had brought from the farm. Ve cached the remainder of the hay for the ponies on their return.

Over ridges of rubble, across valleys of sand, wind-driven and water- ıifted, up, up, we climbed till we reached the snow field, passing Lockstin- ur and its bristling masses of tufa on the left. We turned the ponies irectly into Jónskard, sharply outlined against the evening sky. In most laces the snow was sufficiently hard for the ponies to carry us with ttle slumping. Now and then treacherous spots let the ponies through ıd the rider, of necessity, was forced into the slush to extricate the ruggling horse.

About 9.30 in the evening we came to the most rugged portion of the limb. Indeed, it seemed most difficult because we were somewhat exhausted 'ith our long hours crossing the lava. We dismounted and led the riding onies in single file, while the pack horses, with the tent and supplies, were riven in advance. We made a zigzag trail up the cinder ridge. Often-

times masses of débris gave way and went scurrying into the snow ravi
below.

As we turned the corner of a massive ridge, I said to the Icelanc
"John's Pass?" "Yes, yes, John's Pass," he replied. "Nay, nay," s
I, "John's Mountain." He laughed, shook his head, and we proceeded

At 11.30 our hard work was over and we entered Jónskard upon
firm snow. At midnight we gained the summit. At this altitude and ele
tion the sun gave ample light, so that the shadows of the mountain w
cleancut across many miles of snow and sand.

Midnight! I shall never forget it! Standing at the summit
Jónskard, I looked toward the north. The lake glimmered in the midni
light and the round dome of Sellandafjall concealed the midnight s
but broad streams of sunlight radiated from either side of the summit a
a flood of sunlight bathed the summit of Bláfell. Between us and th
mountains were many miles of lava desert. To the east and north r
prominently the snow-capped volcanoes, Búrfell, Kerling, and, fart
east, the unscaled summit of Herdubreid, nearly 5,000 feet in altitu
On our immediate right and left the tufa ridges of Askja's crater r
hundreds of feet above the pass. Wild and magnificent as is the north
view, it is not to be compared with the beauty of the gem in its lov
setting that lay in the mighty crater at our feet. The initial task
completed. The object of our expedition, the survey of the crater,
to begin. A depression at least four miles across and circled with a ch
of mountains gives the crater the name Askja, or the Bowl.

The eye was led directly across the blackened snow fields to the jev
Knebelsvatn, a lake in the mammoth tube of the crater near the south
wall. Its color is a deep turquoise of a depth and brilliance such a
had never seen in the stone itself, so clear, so quiet, and serene in
midnight silence. The blue deepened here and there by the shadows
the overhanging crags. The smoking solfatara on the eastern shore
sending its columns of steam and gases above the crater wall, glistening
the midnight sunshine, reminding us forcibly of that other pillar of cl
and the column of fire which in ancient days separated the Chosen Peo
from the Egyptian host. For fifteen minutes we stood beside the po
and drank in the wondrous beauty of this scene and received the imp
sion of its terrible desolation. No sound was heard save here and th
the rolling stones down the crater slopes started by an occasional ea
tremor, which echoed forcibly from the past and impressed us with
fact that, if the Plutonic giant were sleeping, his slumbers were
peaceful.

Tired and hungry we pitched the tent on the narrow edge of the bl
and red cinder mound (15 on the map, Fig. 6) between two ice mas
the one at our back affording some shelter from the wind. It was
a tinge of sadness that we said goodby to the farmer as he started on

ıesome journey of twelve hours down the mountain to his home. He ıs an old man, yet strong and vigorous, whose hospitality we had thorghly enjoyed at Svartákot and whose ready wit and store of information, his broken English, beguiled the weary hours of our climb. As the ponies ıttered up the pass, we crawled into the sleeping bags and slept the clock und.

On July 14 at noon we began our examination of the crater. Our first ep was to measure a base line of 600 feet on the hard snow above the ıt. From each end of this line we took a round of sights to each of the ominences in the entire circle of the crater. We made a series of photoaphs, so that when placed side by side we had a complete panorama of e crater floor, the encircling mountain, and the lake. From our data hoped to be able accurately to construct on paper the entire crater by angulation. When we discovered that the magnetic variation in a stance of 600 feet was 14°, we found on working out our figures that the sults were inaccurate. Yet they were near enough for a reconstruction ıich would convey an accurate idea of the physiographical features.

On the following day we made a journey across the crater floor to ıebelsvatn. From our tent it did not appear difficult, but when we found e floor rifted and cracked in all directions, with great areas covered th snow and arching the cracks in a treacherous fashion, the task proved ›st difficult and the journey required nearly four hours. Oftentimes waded in the melting snow to our knees and sometimes to our hips. We countered many ridges of tufa which required long detours of difficult mbing. When within half a mile of the lake, we passed out of the snow to the pumice sand, and here the cracks were more numerous and ngerous. In many places the crevasses are arched with frozen snow d pumice. Accidentally I broke into one of these, and had it not been r the 150 feet of rope with which the three members were tied 75 feet art I would never have returned to write this account. We tied a rock the end of our rope and lowered it into this crack its entire length thout touching bottom. It has never been known for certain how Knebel d Rudloff lost their lives in the crater, but it was our belief that they ll into some such crevasse as this. The story current in Europe is that ey tried to navigate the lake in a rubber boat, that the hot water melted e boat and they were drowned in the scalding water. If the water was t enough for this we cannot believe that two men of their judgment ›uld attempt such a feat.

With difficulty we descended the southern edge of the escarpment to e water's edge and found the temperature of the water to be 7½° C. ı the eastern edge the water boils where it comes in contact with the lfatara, and steam is constantly rising. Our engineering aneroid gave e elevation of the surface of the lake as 3,317 feet above the sea. This ,ure is of scientific value because a dispute has been current in Europe

FIG. 2.

FIG. 3.

FIG. 2—Askja: General view from the cinder ridge (15 on the map, Fig. 6) southeast across the cra floor. Thorodssenstindur (11 on the map, Fig. 6) in the middle distance.

FIG. 3—View northward across the crater floor. Herdubreid (direction of point 14 on the map, Fig in the distant center, outside the crater rim.

Fig. 4.

Fig. 5.

Fig. 4—Jónskard, the depression in the northwestern section of the crater wall, viewed from the cinder ridge inside the crater. Erkesfell at right (16 on the map, Fig. 6).

Fig. 5—The character of the crater floor from the foot of the cinder ridge. Cracks and basins encrusted with snow and pumice sand. In the left background, lava stream (8 on Fig. 6).

as to whether the lake has been rising or falling. Dr. Erkes told me tha the first piece of work he would do in Askja would be to estimate th altitude on a given date. Heretofore the surface of the lake between th escarpment of the crater floor has been either estimated or measured b throwing a line over the cliffs, and, since no one erected a pile of stones t show where he measured th altitude, it has been impossibl to check one man's work agains another. When the altitude o the surface of this sheet o water above the sea is agai taken it will be easy to settl the question as to whether th lake is rising or subsiding.

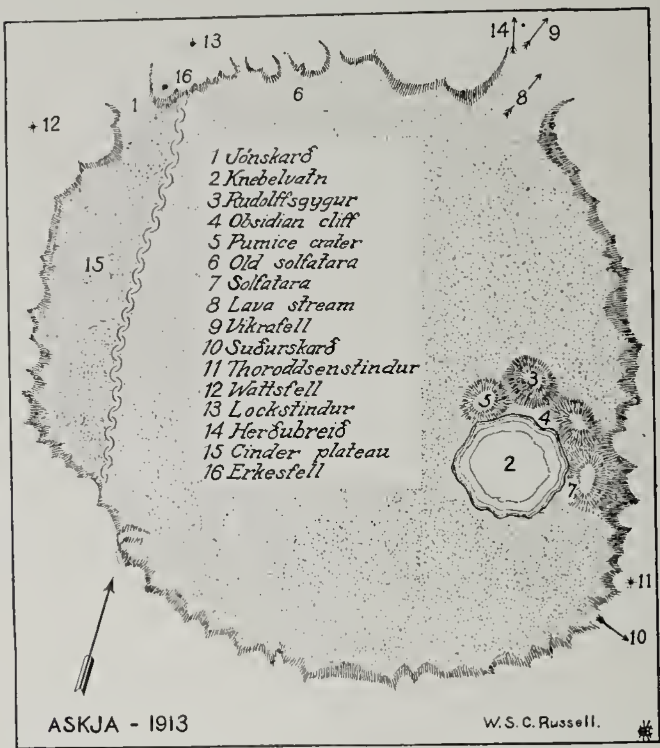

Fig. 6—Sketch-map of the crater of Askja, east-central Iceland, made from observations by the writer in July, 1913. Approximate scale, 1:175,000.

For other maps of the crater see Spethmann, *op. cit.* in footnote 5, p. 2, 1:200,000, and von Knebel-Reck, *op. cit.* in footnote 6, p. 196, 1:300,000.

On the accompanying ma (Fig. 6) the numbered plac within the crater wall are def nitely located by triangulatio The direction of the promine mountains without the crater indicated by arrows. Jónskar (1) is a depression in the nort western part of the crater ri which leads into the great cind plateau (15). This plateau largely covered with snow a ice, and it was here that w pitched our tent. The desce into the crater floor is precipitous. This floor has been described, and remains to state that the pumice areas are just west of Knebelsvatn (2 The greatest solfatara (7) is east of the lake at the foot of the precipito cliffs. The north shore of the lake is marked by steep and irregul obsidian cliffs (4). The crater from which the last pumice was ejected at (5). The more recent outpouring of lava escaped from the crater in northerly direction (8).

A sketch made by Lieutenant Caroc is an accurate view of the crat as it appears when seen from Jónskard, but if one descends into the crat and reaches the southern edge of the lake the crater appears as show on the southern portion of the accompanying map. In Caroc's map t lake is farther to the north, and the south wall of the crater borders t lake, which is incorrect. The number of photographs which we made fro all portions of the crater floor establishes the correctness of this stateme For instance, Herdubreid (14) is not visible from Jónskard (1) but fro the western shore of the lake. This ice-capped dome shows prominent

n the photographs in the direction of the arrow (14). Vikrafell (9) hows from the cinder slope at (15). Wattsfell (12) and Lockstindur (13) re prominent tufa cones rising on either side of Jónskard outside the crater vall. Thoroddsenstindur (11) is a sharp peak surmounting a long ridge ust outside the true crater rim in the direction of Vatna Jökull. The name was assigned to this peak by Dr. Erkes. Beyond this mountain the ce cliffs of that portion of Vatna Jökull, known as Bruar Jökull, rise high above the lava field. The cliffs on the northeastern side of Jónskard rise nearly 1,000 feet above the pass, and I have named this mountain 'Erkesfell'' (16) in honor of a gentleman who has done much valuable opographical work in the interior of Iceland.

The topographical features of Askja have been briefly outlined in this paper. Much work remains to be done, not only in the crater but in the practically unexplored and unmapped territory around the Bower Mountains, especially between Vatna Jökull and Askja and the extensive areas directly north and eastward.

NEW ENGLAND SNOWFALL

By CHARLES F. BROOKS

In autumn the mountain tops in northern New England whiten, an with each storm the snow line descends the foothills to the lowlands an leaps southward. Sunshine and southerly winds force temporary retreat On the highlands the snow accumulates to considerable depths, whil the fight between the enveloping snow cover and the consuming warmt is still changing the color of the surrounding landscape every fe days. A November snow flurry may sprinkle all New England with whit but in the lowlands of the south it is gone the next day. The whit hills remain as outposts of the advancing snow. Late in winter the sno cover may finally conquer the warm south, burying it almost hopelessl in one big storm. Frequent small additions keep the depth equalize as the lower layers become compacted into granular snow and are finall cemented into gray, bubble-filled ice. In March, as the sun rises highe and higher, the retreat of the line becomes inevitable. A great thaw ma start it, or the steady process of sun-melting and evaporation may slowl and surely roll back the snow edge. Nantucket, Martha's Vineyard, Cap Cod, and a thin strip along the south and east shores become brown. B the middle of the month the ragged gray edge of snow has crept up th Merrimac valley to Concord and up the Connecticut to Massachusetts, leav ing behind white projections and spots in the tongues of highland an isolated hills. Winter now and again thrusts his mantle to the sea, onl to have it returned when warm winds and rain wipe the snow traces fro coastal New England and send the muddy water coastward in swolle streams. In the mountains and in the cold and more or less elevate interior of northern Maine, the melting of the snow is a slow process Northward and up the mountains the line advances, until in May or Jun little evidence of the vanished snow remains except the bent lower branche of the trees and the seemingly impassable logging-roads with their flanking tree-stumps cut four or five feet above the ground. The snow cover, which in September or October began with successive mantles of white, ends in mid-summer on some northern mountain in wet and misty drifts protecte from the sun by rock and tree.

Snowy Winters and "Old-Fashioned Snowstorms"

The heavy snowfall of the winter of 1915-1916 in New England has occasioned renewed interest in the subject of previous snowy winters and of the factors controlling the average distribution of snowfall. In spite of the fact that the total depth of snowfall over most of New England was from six to more than eight feet last winter, there have been at least two much snowier seasons (1716-1717 and 1786-1787) since the beginning of the

ghteenth century. Some of the great storms of northeastern Massachutts are interestingly recorded in Sidney Perley's "Historic Storms of ew England."[1]

In December, 1716, snow fell to the depth of five feet, rendering traveling very fficult, and almost impossible except on snowshoes. The temperature throughout the inter was moderate, but the amount of snow that fell that season has never been ualed in New England during the three centuries of her history. Snow fell in conderable quantities several times during the month of January, and on February 6 it y in drifts in some places twenty-five feet deep, and in the woods a yard or more on e level. The great storm began on February 18, and continued piling its flakes upon e already covered earth until the 22nd; being repeated on the 24th so violently that l communication between houses and farms ceased. During the storm enough snow ll to bury the earth to the depth of from ten to fifteen feet on the level, and in some laces for long distances it was twenty feet deep. Indians who were almost a hundred ears old said that they had never heard their fathers tell of any storm that equaled is. Many cattle [and sheep] were buried in the snow, where they were smothered r starved to death.

Nineteen out of every twenty deer are thought to have perished in the now or to have been devoured by the famished wolves. "Many a one-story ouse was entirely covered by the snow, and even the chimneys in some nstances could not be seen." At the end of March the "post" between Salem and Portsmouth took nine days going and eight returning on snowhoes. "In the woods he found the snow five feet deep, and in places it neasured six to fourteen feet."[2]

The winter of 1740-1741 was not only "severe in temperature, but great nows came until, in the estimation of the people then living, taking it s a whole, it was the most rigorous season that had been experienced here ince the first settlement." After a foot of snow fell on April 7, the snow was four feet deep on the level.[3]

An extreme cold spell in November ushered in the winter of 1786-1787. After the first December snowstorm, which lasted from noon on the 4th to the night of the 5th, the snow lay six feet deep in Boston. "The newspapers of that time said that it was as severe a snowstorm as had been experienced for several years." Another storm from the night of the 8th to the morning of the 10th added so much snow that "it was estimated at this time there was more snow on the ground than there was in the winter of the great snow, seventy years before." The remainder of the winter was also severe.[4] The total fall of snow in these two storms was probably not in excess of six feet, for, while men were reported lost in the snow, all communications were not blocked, and houses are not said to have been buried.

In the eighteenth century there were apparently two other winters in which the total snowfall in northeastern Massachusetts exceeded six feet: 1747-1748 and 1798-1799.[5] In the nineteenth century at least four winters in this region had more than six feet of snowfall: 1801-02,[6] 1856-1857,[7]

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[1] Salem, Mass., 1891.
[2] Perley, *op. cit.*, pp. 31-36.
[3] *Ibid.*, p. 51.
[4] *Ibid.*, pp. 124-125.
[5] *Ibid.*, pp. 54 and 153.
[6] *Ibid.*, p. 161.
[7] *Ibid.*, pp. 323-328.

1873-1874, and 1898-1899. Furthermore, in the twentieth century th have already been two such winters in northeastern Massachusetts: 19(1904 and 1915-1916.

Thanks to Sidney Perley's compilations and to the records of t Weather Bureau and Signal Service at Boston, it has been easy to ma this rough comparison of the history of snowy winters of the past two three centuries. It would appear that the tremendous New Englai winters of long ago were no more numerous, and, with two exceptio perhaps no more snowy than some in the present century. The extre snowiness of 1716-1717 and 1786-1787 rests largely on the snowfalls of t weeks with two snowstorms each.

A real "old-fashioned snowstorm" is described as one in which roa and fences were obliterated or communications by road blocked for da and in which the drifts were so high that many people had to make tunne through them to get out of their houses at the ground floor. In additio the experiences of men lost in the snow and of vessels blown on shore a commonly mentioned. Meteorologically, this means an intense coast cyclone with a northerly gale and snow falling at a rate of an inch an ho for a day or more. In northeastern Massachusetts there seem to have bee only seven such storms in more than two hundred years, these seve occurring in but five of the twelve very snowy winters of the same perio

Table I—Seven Snowstorms of Northeastern Massachusetts

Date	Duration	Probable amount of snowfall
February 18-22 and 24, 1717	Probably 5 days	9-10 feet
December 4-5, 1786	1½ days	3 feet
December 8-10, 1786	1½ days	3 feet
November 17-21, 1798	4 days	3-4 feet
February 21-27 (?), 1802	Almost a week	Several feet of snow and ice (perhaps
January 18-19, 1857	Less than a day	3 feet or less

In Boston, since government records began in 1871, the measurements sho no month with more than three feet of snowfall.

An important feature of New England snowstorms is their loca character. The account of snowy winters and great snowstorms for north eastern Massachusetts does not agree with the history of snowfall for othe parts of New England. For example, the following three snowstorms sinc the middle of the eighteenth century are most famous in the New Bedfor region:

Table II—Three Snowstorms of the New Bedford Region*

Date	Duration	Probable snowfall
December 26-27, 1778		3-4 feet (?)
December, 1786		"A great quantity of snow fell"
January 15-16, 1831	Intense snowfall 24 hours, total about 34 hours	3 feet or more

* From a sheet published by Thomas R. Rodman, New Bedford, Mass., March 4, 1902.

further evidenee of the loeal eharacter of snowstorms is the faet that
e snowfall of months and even of the individual seasons is often quite
fferent at places not far apart, as witness the following table:

BLE III—SEASONS WITH MORE THAN 66 INCHES OF SNOWFALL MEASURED AT BOSTON OR NEW HAVEN

nter 1873-74	New Haven 68.8 inches	Boston 96.4 inches
1880-81	69.5	53.8
1886-87	46.2	73.0
1887-88	66.2	41.2
1892-93	74.2	67.3
1896-97	67.4	43.2
1898-99	66.4	71.1
1903-04	42.7	73.1
1906-07	64.3	67.9
1915-16	76.0*	79.2*

* Since January 1, 1909, regular Weather Bureau stations have measured sleet separately. Thus if sleet re included, the total for New Haven would be 82.3 inches instead of 76 inches.

ı southern Connecticut, the snowstorms of February, 1717, were extreme; ıd that of March 11-14, 1888, has left a strong impression on the people. 'inslow Upton says:[8] "The great prominence given to the storm under ınsideration was due to the fact that the form of the precipitation was ıow and that it fell in the vicinity of New York, causing almost a complete ıspension for several days of the railway traffic centering in that city." verett Hayden[9] shows that 135 sehooners and 81 other vessels were lost ong the Middle and North Atlantie eoast of the United States during this orm. The monograph contains an exeellent set of colored weather maps. ıow fell for about two and a half days, and the depth in southwestern ew England and eastern New York was estimated at 2½ to 4 feet on the vel, the greater depths being along the Hudson and up on the west slope the Berkshires and the southern Green Mountains and in eentral onnectieut (see Fig. 3, map from Upton). Snow-drifts with a maximum eight of 15 to 40 feet were reported.

It is evident from the seattered examples just mentioned that "old-ıshioned snowstorms" are not phenomena of the past. Four feet of snow ı one storm seems to be the maximum whieh can be expeeted in southern 'ew England. Only on one oecasion, February 18-22, 1717, was there pparently as much as six feet. From an inspeetion of the tables of snow-orms showing the duration and amount of snowfall it is apparent that ıow usually does not fall at a rate exceeding one inch an hour.[10] In ›uthern New England, speeial meteorological conditions which will

[8] *Amer. Meteorol. Journ.*, Vol. 5, May, 1888, pp. 19-37.

[9] *U. S. Hydrogr. Office Nautical Monographs No. 5*, Washington, 1888.

[10] Upton (*op. cit.*, p. 36) published a table showing the rate of precipitation near the maximum area in e storm of March, 1888. At New Haven, where the snowfall was estimated at 42 inches and the water ntent as 4.50 inches, in other words about 10 to 1, the precipitation rates were as follows:

March 11, 10 P.M., to March 12, 7 A.M.	0.1
March 12, 7 A.M., to 3 P.M.	0.14
March 12, 3 P.M., to 10 P.M.	0.11
March 12, 10 P.M., to March 13, 7 A.M.	0.07

favor the long continuance of snowfall may very rarely bring a fall snow amounting to as much as six feet locally, and if repeated after interval of a day or two may result in as much as ten feet within the lin of one week. This happened two hundred years ago and almost occur in a five- or six-day storm of snow and sleet one hundred years ago. If of our modern snowstorms should last four days instead of two or th New England in this century might have a great snowstorm equal to t of 1802 or 1717.[11]

Heavy New England snowstorms have occurred with a number of co binations of weather conditions. A cyclone over the Great Lakes and off the South Atlantic coast may join south of New England and m thence northeast. This combination makes a strong cyclone; and, as i south of New England, the cold northerly winds and the moist east ones combine to produce the requisite low temperature and moistu When there is a snow cover already, the cold air and the consequ tendency for an anticyclone to stick over New England serve to intens and delay the cyclone.[12] Blue Hill Observatory (Massachusetts) reco show that, in general, the greater the number of days with snow on ground in a winter month (December to March) the lower is the te perature relative to the mean. Furthermore, in months with long sn cover occur the greatest inversions of temperature between the top of hill and the valley station 600 feet below. With an average depth of inches of snow on the ground on February 15, 1899, simultaneous t peratures at the top of the hill and in the valley were 8° F. and —20° the greatest difference recorded there up to that time.[13]

The other common type of cyclonic arrangement favoring New Engl northeast snowstorms involves a single cyclone which fights its way up coast against the southward circulation on the east side of a great a cyclone lying dormant over the intensely cold snow-covered ground. Su was the case with the snowstorm of January 18-19, 1857, and Februa 11-14, 1899.[14] In addition, any combination which results in the pass

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[11] The winter of 1801-1802 was very mild until late in February, when a storm which "continue nearly a week covered the ground with snow and sleet to the depth of several feet. Intense cold vailed, which . . . caused the sleet to freeze upon the snow, forming a crust so hard and thick tha people, not distinguishing the location of the roads, drove in their sleighs across lots over fences walls." (Perley, *op. cit.*, p. 161.)

[12] A good example of this may be seen on the weather maps for the last week in March, 1916, whe anticyclone stayed over snow-covered New England, delaying and forcing to the south a cyclon proaching from the west. See also "Weather Forecasting in the United States," by a special b composed of A. J. Henry, chairman, E. H. Bowie, H. J. Cox, and H. C. Frankenfield, *Weather B* [*Publ.*] *No. 583*, Washington, 1916, pp. 107, 133, and 139.

[13] A. Woeikof has discussed the influence of snow cover fully in: Der Einfluss einer Schneedeck Boden, Klima, und Wetter, *Penck's Geogr. Abhandl.*, Vol. 3, No. 3, Vienna, 1889 (reviewed in *Amer. Met Journ.*, Vol. 7, 1890, pp. 332-336). A more recent publication is that by O. V. Johansson: Dämpf Wirkungen des Schnees und Eises auf die Lufttemperatur, *Öfversigt af Finska Vetenskaps Soc. Forh* Vol. 60, 1912-13, Aft. A, No. 11.

[14] The storm of 1899 is mapped and described by the writer in the *Monthly Weather Rev.*, Vol. 42, pp. 318-330. For a general discussion, see "Weather Forecasting in the United States" (cited in footnot pp. 253-256 and Figs. 163-166.

a strong cyclone immediately south of, or northward through, New England, while an anticyclone on the northeast or north is in the way, favors occurrence of a heavy snowstorm if the temperature is low enough. In rch, 1888, an anticyclone following the passage of a cyclone north of w England entered New England on the west just as a southern center s approaching the south shore. The difference in temperature, which one time was 25° F. in 75 miles, favored the development of a strong lone, while the wind circulation and southeastward tendency of the icyclone prevented the normal northeastward movement of the cyclone.

Snowy winters, while sometimes taking their character from a single rm, are the result of the passage of a number of cyclones south of or ough New England. Cold winters are more snowy in southern New gland than in the north, while warm winters may lead to excessive owfall in northern New England by reason of greater moisture in the (compare 1915-1916 with 1900-1901, Figs. 18 and 19). As the past nter was for southern New England in general the snowiest in more than ty years and was exceeded over a wide area perhaps only twice in two turies, the meteorological conditions producing it may give some indican as to the immediate cause of such snowy winters. In the three snowy nths, December, February, and March, cyclones passed south of, or ough, New England. In December and March, the snowiest months, the rth Atlantic cyclone was stronger than usual, particularly so in the very owy March.[15]

In the same way, there may be some significance in the fact that none ossibly one) of the 153 Hamburg and Bremen whalers in the Greenland a in the summer of 1716 were lost, while, between 1697 and 1719, on the erage four were lost each summer, the summer of 1700 being the only ner one without losses.[16] As weather colder than normal is the accomniment of a strong Iceland cyclone, there may also be some connection tween the great amount of ice off the east coast of Greenland in the mmers of 1786 and 1787 and the intervening severe winter in New ngland.[17] In the cold, snowy summer of 1816 there was an abnormally ong sub-permanent cyclone in the Greenland Sea and accompanying cold rthwest winds in New England.[18] These citations are mere suggestions to the way in which snowy winters in New England may be explained d perhaps later forecast. The proof awaits the study of a much longer ries of years, considering mild as well as severe winters.

A glance at the snowfall record of Boston suggests a connection between ccessive winters. In the past 45 years, each of the four occurrences of

[15] See C. F. Brooks: World-wide Changes of Temperature, *Geogr. Rev.*, Vol. 2, 1916, pp. 249-255.

[16] C. G. Zordrager: Grönländische Fischerei und Wallfischfang, Leipzig, 1723, pp. 370 and 376.

[17] Wm. Scoresby, Jun., ("Account of the Arctic Regions, etc.," 1820, Vol. 1, Appendix 3, p. 69) says that nish ships could not approach closer than 50 miles to the east coast of Greenland in 65° N. in July, 1786, miles in August, and 30 miles in 1787.

[18] For details of the summer of 1816 in New England, see Perley, *op. cit.*, pp. 204-213; for conditions in Greenland Sea at the same period, see Scoresby, *op. cit.*, Vol. 1, Appendix 1.

seasonal snowfall in excess of 70 inches was followed in the second se
after by snowfall below 38 inches, the amount being less than 20 in t
of the cases. There were but four seasons with less than 20 inches.

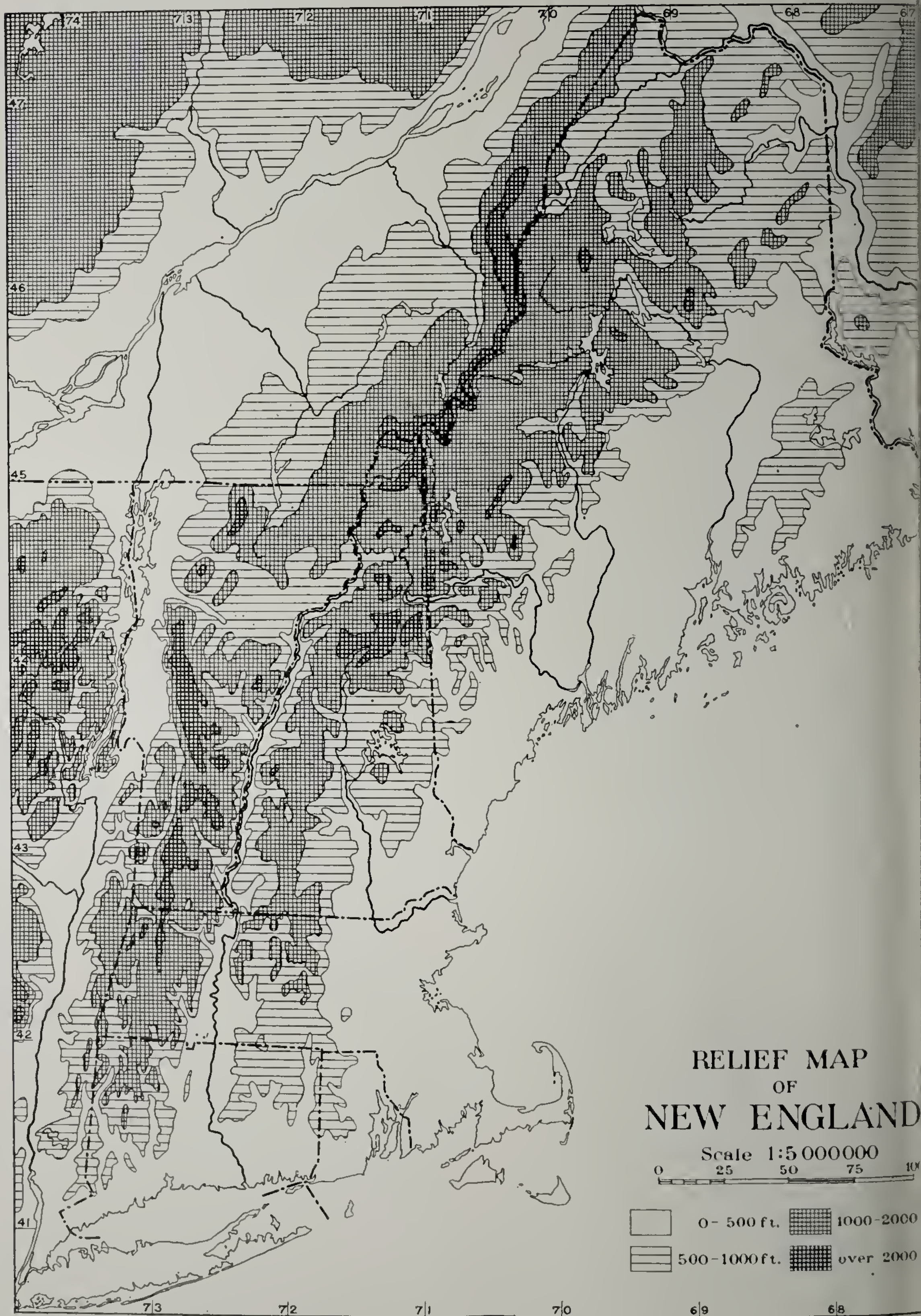

FIG. 1—Relief map of New England. Scale, 1:5,000,000.

In New England the contours are based on the current edition of the U. S. Geological Survey co
map of the United States, 1:2,500,000; in Canada, on J. G. Bartholomew's Orographical Map of th
Lawrence Basin, 1:5,000,000, accompanying S. E. Dawson's "The St. Lawrence Basin and Its Borderla
London, 1905.

winter of 1917-1918 in Boston be one of less than 20 inches of snow-? The New Haven record with less extreme variations shows no such tion.

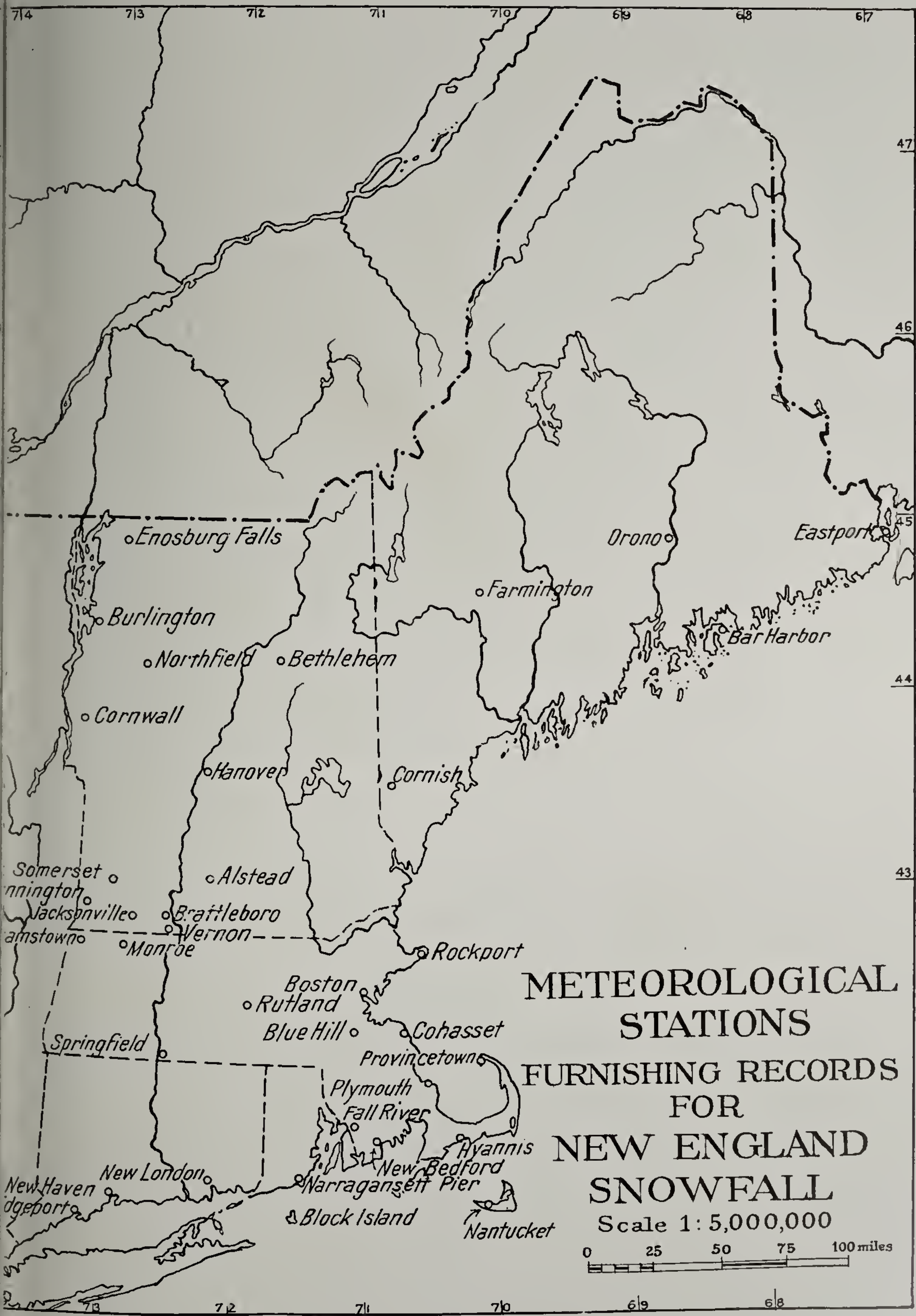

FIG. 2—Outline map of New England showing the location of the snowfall stations mentioned in text. Scale, 1:5,000,000.

Monthly and Seasonal Snowfalls

Some indication of the effect of altitude, latitude, and exposure on t amount of snowfall has already been made. In spite of New Englan small area, its snowfall differs greatly in different parts, such inequalit being due primarily to these three factors. New England snowfall may considered in two divisions: the western and northern mountainous secti and the lower coastal region. In the mountains, the greater the altitu the heavier is the snowfall, as a general rule. While the temperature co trol of latitude and altitude on snowfall is important, the exposure snow-bringing winds and the proximity of water surfaces to windwa cannot be overlooked. For example, the Green Mountains become progre ively snowier southward on account of more open exposure to moist easte winds from the Atlantic (see discussion of February, 1916, map, Fig. 11)

Heavy snowfall on one side of a range of mountains or hills is acco panied by light snowfall on the other side, for any winds after losi moisture on one side arrive as warming drier winds on the other. Mou tains cast shadows in the sunlight, and just as truly they cast "sn shadows" in snow-bearing winds. The Champlain valley is in the sn shadows of both the Green Mountains and the Adirondacks, and so i region of relatively small snowfall. The least snowfall in Vermont, exce in the extreme southwest, occurs at Burlington behind the highest part the Adirondacks on one side and the White and Green Mountains on other. The upper Connecticut valley is similarly affected.

On the immediate coast, winds blowing freely off the ocean are chil and made to yield up some of their moisture as they lose velocity and over the land. If the wind is at a temperature just below freezing it n swirl onto the land in clouds of dense snow. In general, it is cold enou for snowy ocean winds only in February, March, and April.[20] Inland little way, if the land were flat, a belt of maximum snowfall would soon reached, for it is here that the wind behind is most crowding against a piling over the lower wind, retarded by friction. Perhaps this is w Hyannis has more snowfall than Rockport, Provincetown, and Nantuck

Where for some distance inland the country is rising, the zone of ma mum snowfall is farther from the shore and the snowfall is more inte because of the heavy precipitation produced at lower temperatures. S is the case some forty miles inland in western Maine and eastern Ma chusetts. Beyond the crests of the divide the snowfall decreases somewh but not so rapidly as toward the warm ocean. Thus, in south-cent Maine, the upper Merrimac valley, the lower Connecticut valley, and e

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[19] Evidences of local glaciation have been found and described by G. D. Hubbard (paper read a thirteenth annual meeting of the Association of American Geographers, New York, December 28-30, on the east side of the Green Mountains of southern Vermont. See U. S. Geological Survey topogra sheet, Wilmington, Vermont.

[20] See the writer's maps of the snow-bearing winds over the eastern United States, in *Monthly W Rev.*, Vol. 43, 1915, Pls. 12, 14, 16, and 18.

·n Rhode Island, the snowfall is appreciably less than in the but slightly ·gher region on the east. Other factors which lead to the decreased snow-ıll of inland valleys are the weaker cyclonic action and the usual higher ımperatures at the lower elevations.

Some snowfall comes with westerly winds, thus at times reversing the de of the divide on which snow is at its maximum. The snowfall distribu-on of coastal New England is not unlike that of the mountain. In this ıse, the immediate shore, even when flat, has somewhat the effect of a ınge of hills: when the temperature is low enough the snowfall near the ıore is heavy, and snow-shadow areas are developed behind, especially in ıe valleys.

Data

In preparing the accompanying maps, all the readily available published ıowfall data for the period 1895 to 1916 were used. For the maps of ·erage snowfall the records from 178 stations were used; but there are ıly 30 complete records of the 21 seasons. These data appear sufficient allow a fairly accurate mapping of the distribution of snowfall. The ldition of three years of complete records and the use of short-period ·cords for filling in have led to representation of the average snowfall ffering somewhat from that shown on the maps already published by the riter;[21] but the alterations are in details, and follow the principles indi-ıted by the earlier maps. These features stand out all the more clearly ith the removal of some of the minor irregularities due to shortness of ·riod and lack of stations. The errors of snowfall measurement are so ·eat at times that it is only the accordance of results at stations similarly cated which justifies making maps of "snowfall."[22] The probable error these averages from the true mean (if there were such a thing) is large.[23] ı spite of these errors the following maps consistently uphold one another illustrating the broad principles already mentioned.

The Maps

For the months May to October, inclusive, no maps are published here, ·r except in the mountains the snowfall of these months is negligible. ıowfall in May is nowhere a rarity except on Cape Cod, where none has ·en observed in at least 21 years. In June, July, August, 1816, snow fell New England and even on the coast of Massachusetts.[24] There have ·en occasional snows in these months on the mountains since then. Sep-

[21] *Monthly Weather Rev.*, Vol. 43, 1915, Pls. 9-11, 13, 15, 17, 19-23.

[22] C. F. Brooks: The Snowfall of the Eastern United States, *Monthly Weather Rev.*, Vol. 43, 1915, pp. 2-11, ·companied by the maps enumerated in the two preceding footnotes.

[23] For instance, as computed by Fechner's formula, $E=\frac{1.1955}{2n-1}e$ in which e is the mean departure from ·e average and n the number of years, the probable error E, of the seasonal average at Eastport, Maine, [illegible] per cent., and that at Enosburg Falls, Vermont, 5 per cent.

[24] Perley, *op. cit.*, pp. 204-213.

tember snow is common in the north and not very rare south even to tl central highlands of Massachusetts, while the snows of 1816 seem to hav extended over most of Massachusetts. In October during the past 21 yeai snow has fallen throughout New England. Average amounts in excess (one inch are encountered in the White Mountains and on the east flai of the Green Mountains.

November, 1915 (Fig. 4): The only snowstorm of importance wa brought by a cyclone passing through New England. Thus there wa appreciable snowfall only in the north, and the limits of this fall are rath sharply defined. Light snows occurred on two other occasions. Throughou New England the snowfall was less than the average.[25]

Average November snowfall (Fig. 5) is characterized by small coast amounts, as is the case with the two months just discussed.

December, 1915 (Fig. 6): Most of the cyclones with snow passed throug New England, many of them entering from the south. The storm (December 13 was the most important.[26] In the south the heavy snow wa very dense (0.23, New Haven) and caused great damage to wires an trees; farther north, although the depth of snowfall was greater, the wat content was less. The greatest amount of snow considered from the poi of its water content is, therefore, not coincident with the greatest depth (snow on the ground.[27] As warm winds prevailed in eastern New Englar the snowfall there was light.

December average, 1895-1915 (Fig. 7): As indicated by the foregoi maps, snowfall lines still tend to run parallel to the coast.

January, 1916 (Fig. 8): All the snowy cyclones of this month pass on the north. On this account, only in the north did snow occur in avera amounts, as southerly winds do not favor snowfall. In the south at ma places this January was one of the two or three least snowy Januarys the 21 years.

January, 1904 (Fig. 9): On the 2nd to 3rd a cyclone accompanied by very intense snowstorm passed south of New England. As with oth single storms the snowfall was extreme only in part of New Englan Nantucket had almost 40 inches of snowfall and was ice-bound most of tl month.

January average, 1896-1916 (Fig. 10): Topographic control on snowf distribution is much stronger than that of latitude.

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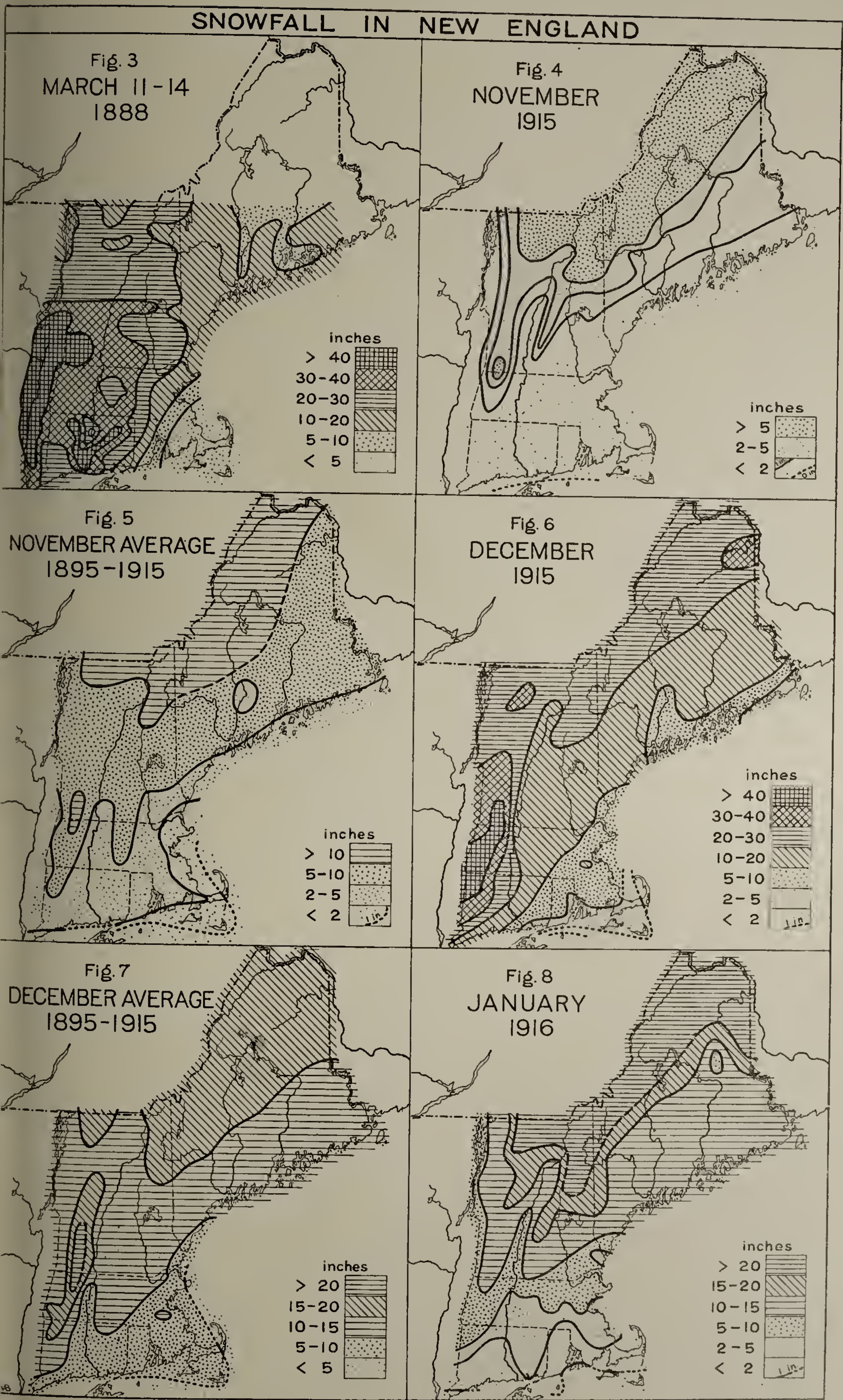
[25] The snowstorm of February 21-24, 1912, in the eastern United States as illustrated in C. F. Broo The Distribution of Snowfall in Cyclones of the Eastern United States, *Monthly Weather Rev.*, Vol. 42, 19 pp. 318-330, specifically Figs. 8-11, shows a remarkably sharp line of demarcation between the heavy sno fall north of the cyclone track and the light snow on the south.

[26] The following depths were reported December 14 by railroad officials and others:

Albany, N. Y.,	20 inches	Springfield, Mass.,	12 inches
Maybrook, N. Y.,	19 "	New Haven, Ct.,	11 "
Greenwich, Ct.,	14 "	Blue Hill, Mass.,	½ inch

[27] The snowfall of March 11-14, 1888, had a density exceeding 0.2 on the immediate coast in the sou but the usual 0.1 in the interior (Upton, *op. cit.*, p. 35).



FIGS. 3-8—Scale, 1:12,000,000.

February, 1916 (Fig. 11) : As the storms passed through New Engla and on the south and as the month was so cold that little of the preci tation fell as rain, the snowfall was rather evenly distributed througho the region, with but little differences due to latitude or altitude. T effect of the ocean is apparent only in that there was much snowfall; sno inhibiting temperatures were not experienced on the east coast, as November, December, and January.

The usual heavy snowfall in southern Vermont is caused apparently the passage of cool, moist winds over the mountains, favored by the ea ward turn of the Connecticut valley at that point, which hinders a furth southward flow of air. This ascent of the air leads to cooling by expansio which causes the increased precipitation. Brattleboro is freely exposed the northeast winds sweeping down the river and is located at the tur Jacksonville is on the highlands on the west but east of the divide. In ve snowy (January and February, 1898) or very cold months (Februar 1899) snowfall at Brattleboro may equal or even exceed that of Jackso ville. Vernon is around the bend of the river, and so its snowfall considerably less. Higher than Jacksonville the snowfall is apparent heaviest. Monroe, Mass., on Hoosac Mountain, and Somerset, Vt., nort west of Jacksonville, have too short records to prove this.

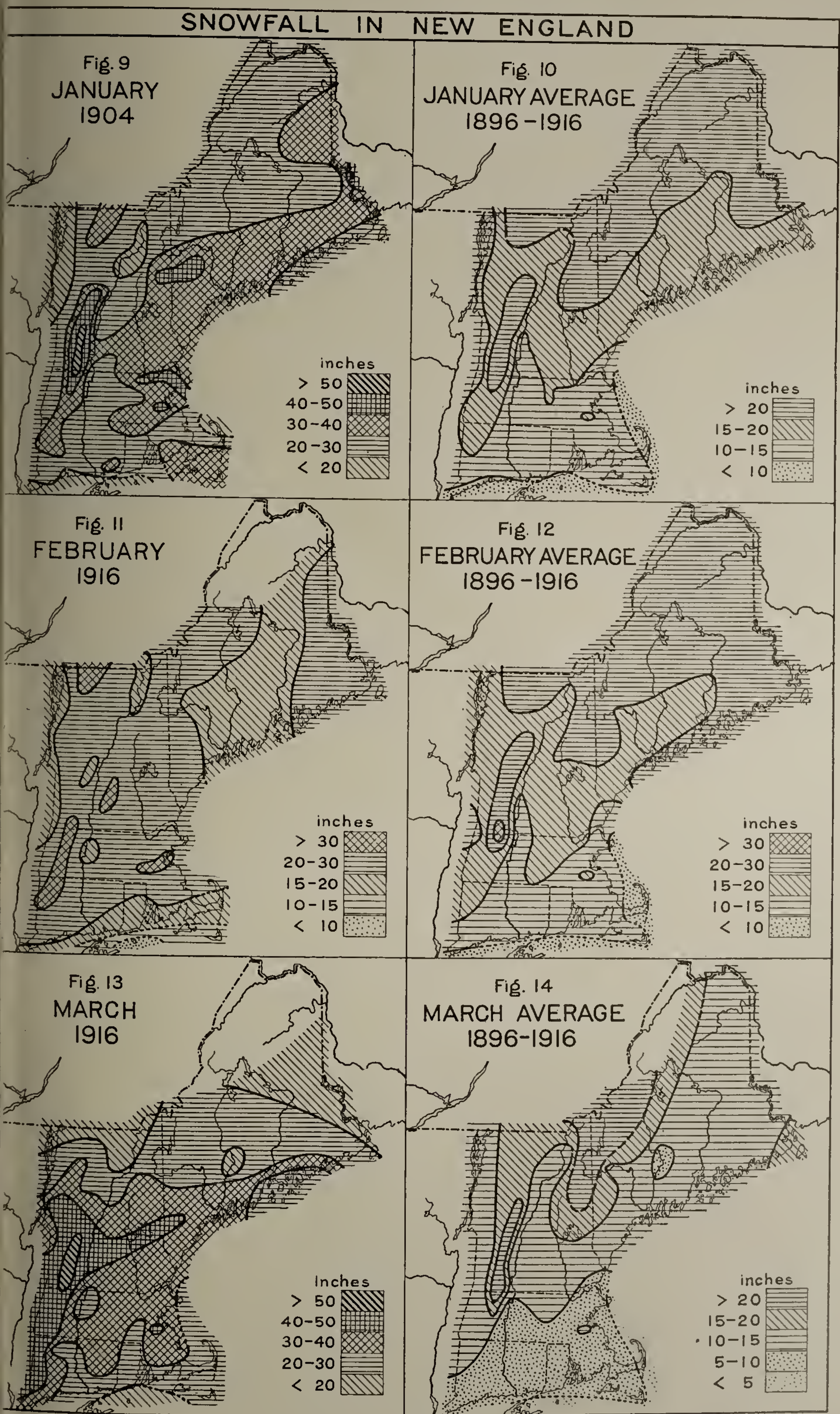
TABLE IV—ALTITUDE, EXPOSURE, AND SNOWFALL IN SOUTHERN VERMONT*

	ALTITUDE (FEET)	AVERAGE 1895-1900	JANUARY AND FEBRUARY, 1898	FEBRUARY 1899	SEASON 1895 96	SEASON 1915-1
Brattleboro	335	97	78	35	79	...
Jacksonville.......	1000	106	74	25	113	...
Vernon............	310	76	62	30	60	86
Monroe............	1860	...	...	...	126	...
Somerset..........	2096	...	...	...	...	161
Williamstown.....	711	...	(38 Bennington)	20	41	119

* Snowfall figures are quoted to the nearest full inch.

In northern New England, west-wind snowfall is encountered in lar amounts where winds from the St. Lawrence valley rise to cross the mou tains, as, for instance, at Enosburg Falls, Vt., with 97 inches avera seasonal snowfall, and Bethlehem, N. H., 85. In February, 1899, there w too little moisture in the air to allow the usual excess of snowfall in the places.

February average, 1896-1916 (Fig. 12) : The ocean now being cold, is possible for heavy snowfall to occur on the coast, especially in Mai This is the month of maximum snowfall throughout New Englar Nowhere is the winter generally so cold that there is a mid-winter reducti in snowfall, due to the reduced moisture capacity of cold air. There is suggestion of such an effect in Vermont, where at most stations the heavi snowfall in any month has come in March.



FIGS. 9-14—Scale, 1:12,000,000.

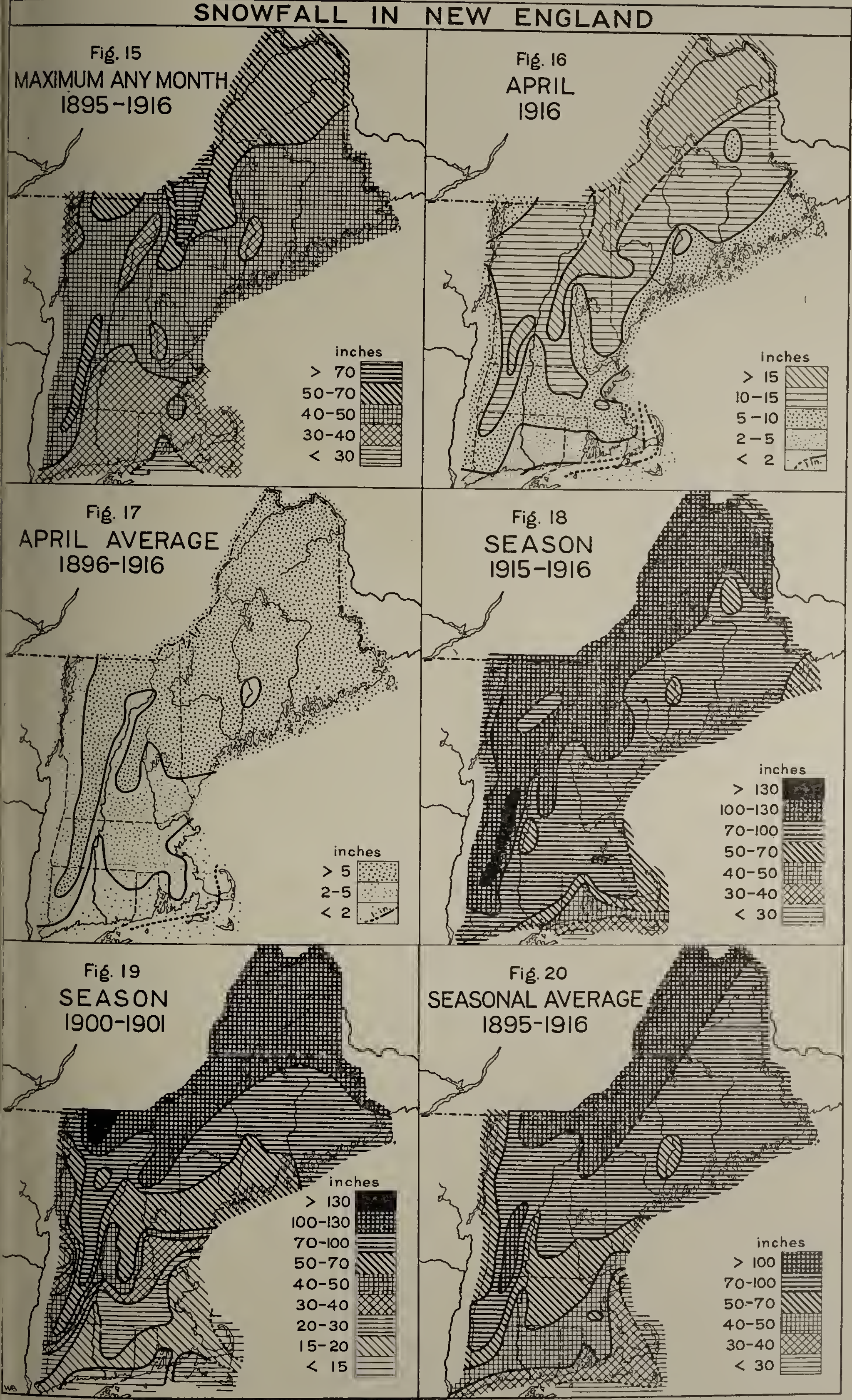
March, 1916 (Fig. 13): Except in the southeast, New England w entirely snow-covered from early February to the end of March. At mo points on the east coast the snowfall was heavier than at a short distan inland, as is to be expected in March. The extremes of the western mou tains were due to the topographically enforced rise of the moist air. As February, most of the precipitation of the month was in the form of sno hence there was more snowfall in southern New England than in northe because of the greater moisture supply.

March average, 1896-1916 (Fig. 14): The snowfall is almost the sa as that of December, except on the coast of Maine. The coast snowfall March is heavier relative to that of the interior than in December.

The maximum snowfall in any month (Fig. 15) equals about half t snowfall of the snowiest season in southern and one-third in northe New England. In the north, January and March were the months wi maximum snowfall, February being third; in the south, this order w February, January, and March; and for New England as a whole, Januar February, and March. Although 21 years is rather a short period to gi these extremes much weight, they seem to indicate to some extent the effe of February cold. In the north, on account of the reduced moisture capaci of the atmosphere it apparently cannot snow so hard in February as January or March, even though the highest average is in February. In t south, where it is usually too warm for much snow, the month of great snowfall comes late in winter, when temperatures accompanying "northe storms" are most likely to be below freezing.

April, 1916 (Fig. 16): Since the snow cover of March lasted into Ap in northern New England, the same condition of southern cyclones w favored. As was to be expected, the snowfall of the extreme northwest w but little above the average. The east-coast snowstorm of April 28 w extraordinary for so late in the season. On Blue Hill the 8 inches of den snow (water content, 1.68 inches) lasted till noon of the 29th, on whi day the temperature reached 61°.

April average, 1896-1916 (Fig. 17): On the east coast April snowf exceeds that of November; elsewhere November snowfall is in the lead. the northwestern half of Vermont the November snowfall is double that April. While temperatures in both months are low enough for snow, the is less tendency to precipitation in April because the winds from the wat surfaces tend to become warmer on land rather than colder, as is the ca in November. At Enosburg Falls, on the west slope in the extreme nort the maximum snowfall in any November was 51 inches, while the Ap maximum was but 11. Many of the snow-bearing winds for this stati come from the Lake region to the west and northwest. On the other han if in April the ground is covered with snow, heavy snowfall may occu particularly on the coast, for the land is then cold relative to the wat



FIGS. 15-20—1:12,000,000.

Thus at Eastport the average snowfall for April (9 inches) is almost twi that of Enosburg Falls (5).

In April the depth of snowfall seems to be more dependent on altitu than in any other month. This may be because the surface ground ter peratures are above freezing, at least in the lowlands. So here, the sno may melt immediately on touching the ground, although it is accumulatir on the adjacent hills. On April 28, 1916, but 2 inches of snow collecte on the ground in the Boston basin, only a few hundred feet below Bl Hill, where the depth was 8 inches. A similar phenomenon occurs i November, but because of the effect of the warm ocean it is not so noticeabl In April, on the other hand, the ocean may be said to be neutral, and s the altitude differences are not complicated.

Season, 1915-1916 (Fig. 18): The season was characterized by ver frequent snowfall, especially in February and March. Only a few storm stand out as extraordinary. Taking the season as a whole, there were eigl snowy cyclones passing to the north, eleven passing through, and eleven t the south of New England. Of the eleven cyclones bringing heavy snowfa four passed through New England and the seven others went by on th south. Three out of the four passing through New England occurred i December, leaving southeastern New England comparatively free of snov The southern cyclones of late winter, however, made up for this early lac of snow. For the season, the result was extraordinary snowfall, partic larly in the west. The topographic control of the distribution of snowfa is patent. Particularly interesting is the heavy snowfall of the Champlai valley, which normally is in the snow shadow either of the Adirondacks c of the Green Mountains. In this season there were north winds with tl snowfall. This produced heavy snows on the west side of the Green Mou tains, of which there are records of 123 inches at Cornwall and 119 a Williamstown. Note the snow shadows east of the mountains. The 97-inc record at Springfield, Mass., may be due to the turn of the Connectic just below Springfield, which obstructs the clear sweep of a north-northwes wind down the valley, in much the same way as at Brattleboro (see dis cussion of February, 1916, map).

Table V—Contemporaneous Snowfall Differences on Opposite Sides of a Mountain Range

West side					East side				
	Average snowfall	Length of record	1895-96	1915-16		Average snowfall	Length of record	1895-96	1915-1
Williamstown....	54	20 yrs.	41	119	Vernon, Vt.....	68	8 yrs.	60	86
Cornwall, Vt.....	70	14 yrs.	55*	123	Northfield, Vt.	82	21 yrs.	90	93

* 8 inches interpolated.

Season, 1900-1901 (Fig. 19): Only one cyclone of this winter brough intense snowfall over any considerable area of New England; this passe

hrough the region. The west winds following the passage of this and other yclones were responsible for the heavy snows at Enosburg Falls (192 nches).[28] This same winter was that in which the maximum of 334 inches f snow was reported at Adams, N. Y., at the east end of Lake Ontario. n many places of southern New England the winter was that with the east snowfall in 21 years (cf. conditions of January, 1916, or of November, 915). The snowfall at Burlington, Vt., was but slightly above the average, nd that of Cornwall, a little farther south and still more in the snow hadow of the Adirondacks, was but 45 inches, only 4 inches above the ninimum in the 14 years of record. Under ordinary conditions, however, ne snowfall at Cornwall is above the median in the same seasons in which hat at Enosburg Falls is in excess, and vice versa.

Seasonal average, 1895-1916 (Fig. 20): The great snowfall of the xposed highlands, the local snow shadows, and the relatively light snowfall f the coast show that the features apparent in the maps of individual easons have sufficient repetition to be shown as usual phenomena. Only n the coldest part of the coast (Maine) does the heavy shore snowfall of ne late winter make the total greater than that a short distance inland.

Summary

Air temperature is probably the first factor in determining snowfall. he latitude and altitude differences in temperature cause the heaviest nowfall, so far as controlled by temperature, to be in the north and on the ighlands. Similarly the most snow tends to come in the coldest month, xcept in the north in winters colder than usual. Although January is as old as February, the snow-bearing winds of February are the colder and o the snowier. The warmth of the coast is less favorable for snowfall han the coldness of the interior.

But without precipitation there can be no snowfall. Precipitation is reatest on highlands, near bodies of water, and near the paths of cyclone enters. The seasonal variations are small in amount.

Wind direction during precipitation is the third important factor con-rolling snowfall. Windward slopes of mountains and leeward shores tend have the most precipitation. Combine the effects of these three factors, nd the distribution of snowfall in New England may be explained.

First, the highlands are the snowiest, for they are cold, moist, and windy. articularly snowy are those slopes which are openly exposed to easterly or ortheasterly winds or, as in the north, to the westerly winds from the reat Lakes. The intermontane valleys have less snowfall because of the igher temperature, less precipitation, and less exposure. In the coastal egion there is plenty of precipitation and open exposure, for the most part,

[28] At Quebec, snow occurred with southwest, west, and northwest winds 17 times at 8 A.M., December, 00, to March, 1901; while the 18-year average is but 7.

so that the snowfall depends chiefly on the temperatures. Thus, in earl winter the snowfall is less than in late winter; in early winter the snowfa on the immediate coast is less than that inland, allowing for topographi influences; and in late winter the snowfall of the coast is the heavier. A New England is the focus of most of the cyclones which cross the Unite States or come up the east coast, there are chances for wide variations i their paths. On this account, all parts of New England are crossed b numerous cyclones. As the strongest ones, however, pass New Englan on the south or cross through the southeast, this section from time to tim experiences extraordinary snowstorms, a great characteristic of the climat of New England.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Meetings of February. An inter-monthly meeting of the American Geographical ociety was held on Tuesday evening, February 6, at the Engineering Societies' Build- g, 29 West Thirty-ninth Street. President Greenough presided. The lecture for the ening was entitled "Petrograd and Moscow: The Rise of the Slav," by B. R. aumgardt. The regular monthly meeting was held on February 20. President reenough presided. He submitted for confirmation the names of 101 candidates for ellowship, each of whom had been approved by the Council, and they were confirmed Fellows of the Society. Thereupon Dr. Arthur L. Day, director of the Geophysical aboratory of the Carnegie Institution, delivered a lecture entitled "The Crater of ilauea." Dr. Day's investigations in the Hawaiian Islands and especially on the order of the crater of Kilauea, with its boiling lake of lava, have been of the most riking character and throw light upon many of the former mysteries of volcanic tivity. Probably for the first time in the history of science, samples of gas were otained from red-hot lava before it reached the air. Dr. Day's lecture dealt with the sults of these investigations.

NORTH AMERICA

Aërial Mail Line between New York and Chicago. In the past few months ere has been a growing interest in plans for a mail service between New York and hicago by aëroplane. It is estimated that the trip can be made in from six to fourteen ours, depending upon the wind, and that the average running time for the 720 miles ir line) between New York and Chicago would be eight hours, or between sunrise d sunset. Problems still to be solved are emergency stations, equipped with lights, nding stages, extra machines with pilots, etc. According to an article in *Flying* for nuary, 1917 (E. H. Smith: New York-Chicago Aërial Mail Lines, pp. 504-506), the ostmaster General has asked an appropriation of $100,000 from Congress for experi- ental purposes.

Highway Tunnels under the Hudson River. One more step in the costly conquest New York's water barriers (see the article by Ellsworth Huntington on "The Water arriers of New York City" in the September, 1916, *Review*) is anticipated by a pro- osal made to the New York State Bridge and Tunnel Commission by the engineering rm which built the Pennsylvania Railroad and Hudson-Manhattan tunnels (*Scientific merican*, Jan. 13, 1917, p. 58). The suggested step aims at eliminating the delay to heeled traffic unavoidable in the ferriage system across the Hudson. The operations the system fall into two distinct traffic zones, divisible by an east-to-west line at 3d Street. From a study made for the Pennsylvania Railroad in 1913 it was ascer- ined that, out of a total of 19,660 vehicles crossing the river daily, only 2,000 used e ferries above 23d Street. To relieve the downtown congestion and delay, it is pro- osed to construct highway tunnels under the river immediately south of the Hudson- anhattan tunnels. The two tunnels, one for westbound, the other for eastbound affic, will be 8,350 feet long and will be able to accommodate 5,000,000 vehicles per nnum. Tunnels of this description are in successful operation in some European cities. ondon has two with respective lengths of 6,200 and 6,883 feet. In 1913 each accom- odated about 1,000,000 vehicles.

Recent Development in Southernmost Saskatchewan. The recent construction a branch of the Canadian Pacific Railway through southernmost Saskatchewan and lberta, paralleling almost the whole length of the northern Montana boundary at a istance of 30 to 40 miles, has been followed by a characteristic ingress of settlers. The astern portion of this area, the Wood Mountain-Willowbunch Lake district, has ecently been investigated (Bruce Rose: Wood Mountain-Willowbunch Coal Area, askatchewan, *Geol. Survey of Canada Memoir 89*, 1916). It lies immediately west of e Coteau du Missouri. Through it from east to west runs an apparently base-leveled lateau of Tertiary rocks. The plateau constitutes a portion of the continental divide. n the southern side the topography is roughened by numerous coulees draining to the Iissouri. The surface is unsuited for grain growing and for railroad construction,

and the area is likely to remain the grazing country for which it is particularly w adapted. North of the watershed, however, shallow valleys drain to a small inter basin, within the drainage area of the Saskatchewan. Here the topography is favora for farming, and the yield of wheat is above the average for the Prairie Plains. further stimulus to future progress lies in the mineral deposits recently investigat by the Canadian Geological Survey. The lower Tertiary strata include consideral beds of good-quality lignite and excellent brick clays. The close association of the t materials and their occurrence in a land without timber or water-power resources shou render them peculiarly valuable to the fast-growing population of the West.

Acquisition of the Danish West Indies by the United States. Ownership of t Danish West Indies passed from Denmark to the United States on January 17, wh the ratifications of the treaty conveying the islands to this government were forma exchanged. The title passed with the exchange of ratifications, but actual physic possession will not take place until the purchase price of $25,000,000 is paid Denmark.

The Danish West Indies lie immediately east of Porto Rico and consist of the islan of St. Thomas, St. John, and St. Croix (Santa Cruz) and adjacent islets. St. Thom and St. John form part of the Virgin Islands, which represent the summits of t submerged eastern end of the Antillean mountain chain, of which Cuba, Haiti, a Porto Rico are the most conspicuous members. St. Croix lies somewhat off this stru tural line about 80 miles south of the other two islands, separated from them by deep channel. The area of St. Thomas is about 33 square miles; of St. John, 2 and St. Croix, 74; the total area of the group, including the smaller islands, being giv by the *Statesman's Year-Book for 1916* as 138 square miles and the population in 19 as 27,086. The geographic significance of the islands has already been dwelt upon the *Review* (April, 1916, Vol. 1, p. 299).

With the transfer of the islands, the question of name demands a solution. Possib the best suggestion so far made is the one reported in press despatches from t islands under date of March 3 to call them the "American Virgin Islands." Th would recognize an already existing name (dating from Columbus) and would form equivalent to the current designation of the remaining islands, which are known as t British Virgin Islands. Besides, it would follow the precedent of the similar case of t Samoan Islands, the American members of which, since the division of the gro between the United States and Germany, have been known as American Samoa.

SOUTH AMERICA

Indian Reservations in Argentina. Argentina, where European settlement mo nearly resembled that of the North than in any other Spanish colony, is today the on Latin-American country confronted by an Indian problem comparable with that the United States. The uncivilized Indians with whom the Argentine government concerned occupy the territorial extremes of the country. They include various trib of the Gran Chaco—best known among them the Tobas—and the Tehuelches and On of Santa Cruz and Tierra del Fuego.

The southern tribes present the less serious problem. Their numbers are small a diminishing. According to the Ministry of the Interior (*Memoria del Ministerio d Interior, 1912-1913*, pp. 99-120, Buenos Aires, 1913), the Tehuelches are estimated 700 and the Onas at less than 300 (compare the table on p. 175 in the article by C. Furlong at the beginning of this number of the *Review*). The government has found an *estancia* for their benefit, and others are under the protection of various missions.

These two means of caring for the native, the civil *reducción* and the religious *misió* are also found in the north. The ancient civilizing force of the mission still flourish with the support of government aid. In 1914, for instance, the Franciscans of Sal were granted 20,000 acres on the Rio Bermejo, with authority for exploitation of t forests and various subsidies (*Commerce Repts.*, 1914, No. 247). The first civil reserv tion was founded by decree of 1911 under military authority at Napalpí in the Chac In 1912 it was taken over by the Department of the Interior. The first fruits of t venture appear promising. The Indians have small cultivations of vegetables, cor and cotton and work in the *quebracho* forests. The forest products are sold on t Buenos Aires market, proceeds going to the reservation funds. The government h lately decreed the formation of two more colonies for the Tobas and Pilagas (*Sou American Journ.*, Vol. 81, 1916, No. 12). The one, of 53,000 hectares (131,000 acres is to be located on the banks of the Bermejo, and the other, of 85,000 hectares (210,0 acres), between the Bermejo and the Pilcomayo.

EUROPE

Extension of the Swedish Waterway System. The completion of a canal for ıgoing vessels connecting Lake Venern, in southwestern Sweden, with the port of ·tenburg on the Kattegat, is reported in *Engineering News* for February 22, 1917 p. 297-298). The new canal, an enlargement of an older waterway, has a length of miles and contains six locks for a difference of level of 145 feet. It is known as the ollhättan Canal, and its construction for a length of 47 miles consisted merely in ǝ canalization of the Göta River. Vessels of a draft of 13.2 feet can be accommodated present, and it is intended to deepen the canal for vessels of a draft of 16.4 feet.

The same source reports that a bill has recently been passed by the Swedish Parlia- ınt providing for the reconstruction of a canal—presumably the Södertelge Canal is ·ant—connecting Lake Mälar, at whose eastern end lies Stockholm, with the Baltic, as to make it available for seagoing vessels. When this waterway has also been mpleted, the large part of southern Sweden which can be reached by way of Lakes ·nern and Mälar will be made directly accessible to ocean traffic. Both the Troll- ttan Canal and the Södertelge Canal form part of a larger waterway, known as the ›ta Canal, which leads entirely across southern Sweden from the North Sea to the ıltic by way of Lakes Venern and Vettern, canalized portions of the intervening rivers d smaller lakes, and a final stretch along the Baltic coast from Söderköping at the ad of a fiord in 58½° N. to the Södertelge Canal and thence to Stockholm (see map, 1,000,000, in Meyer's guide-book to Scandinavia, 10th edit., Leipzig, 1911, between . 106 and 107). The elimination of this coastal portion and the transformation of e whole waterway into an inland route is foreshadowed by another project, mentioned the same article, to connect Lakes Mälar and Venern, presumably by the intervening ıke Hjälmar.

Grenoble: A Study in City Geography. In connection with Professor Raoul anchard's recent entrance upon his activities as visiting professor from France at arvard University for the current semester, referred to in the February *Review* . 154), the following analysis of his suggestive "Grenoble: Étude de géographie baine" (Paris, 1911) may be of interest, especially in view of the enormous expansion ıich the war has brought about in that city's industrial life, based, as it is, on water ·wer and therefore independent of the war-created stringency in coal. In this study ·ofessor Blanchard explains the origin and development of an urban center by the nctioning of its physical surroundings.

Grenoble is a confluence town: it lies at the meeting of rivers and valleys, a focus r regions of great natural diversity. Yet in this it is not unique. Many sites in these est Alpine valleys have initially possessed similar advantages. Nor have the rivers ›on which Grenoble stands contributed great positive advantages. Navigation has ayed no vital part in its history, and the low-lying alluvial clays upon which the old wn was built have afforded but a precarious and unhealthful site. In some respects e riverine location has proved a disadvantage. It is indeed to the disadvantageous, ·cause barrier, character of the river that Grenoble owes its origin. Here, where the ont Genèvre route from the Alps to Lyons gains the Isère, is the only point in a long retch of its course where the river could be crossed. From Albertville, where the river ıters a structural depression between the Alps and the Pre-Alps, it pursues a meandering ·urse, unstable and unbridgeable save at the confluence with the Drac. This youthful rrent, with a regimen highly sensitive to variations in water supply, resulting from :avy autumn rains, melted snows of spring, and *föhn*-melted snows of winter, is a ›werful transporting agent. By the great fan built at its mouth it could throw the eandering Isère over to the right wall of the valley and reduce its devious course to a ngle channel. Here, then, was the crossing place and an inevitable town site. As a ·idge town Grenoble existed with little modification at least from Roman days to the ose of the sixteenth century. Its fortunes fluctuated with those of the regions to which ɜ highway led. In the prosperous days of the thirteenth and fourteenth centuries renoble flourished. Its great fair, held for 21 days in September, drew merchants from all parts of the world." The bridge was always the center of animation. We ıve a lively picture of the new one built after the great flood of 1219. This bridge as the object of "tender solicitude"; one made donations to it; it had properties ıd rents and was itself the main street.

It was not until the seventeenth century that Grenoble entered into industrial life. hen the town began to reap the benefits of its diversified regional surroundings. It ıthered the growing industries based on the mountain and fertile valley products— ıbrication of hemp, dressing of leather, manufactures of playing cards and, above all, gloves. Under the unfavorable conditions of the eighteenth century industry stag-

nated; in the nineteenth century it underwent a series of transformations that h made the Grenoble of today a focus of industry, a circumstance at first surprising view of its remoteness from the large consuming and producing centers. In part is due to the nature of its early industries, best exemplified by the manufacture gloves, articles of small bulk and weight and relatively high value. In part it is du the discovery of new products and of new means for developing motive force. L limestone and an excellent natural cement and the anthracite of the La Mure h helped progress in the earlier part of the century. Later came the great adva dependent on exploitation of the "white coal" with which the Alpine valleys are well dowered. Not only have hydro-electric resources supplied power for innumerable centers of production, but in Grenoble they have provided a means towards and reason for the metallurgical industry that is now prominent in the diversified occupati of the town.

But Grenoble is more than an industrial center: its varied functions have made old capital of the Dauphiné a modern regional capital of distinction. Grenoble is adm istrative center of its department, and its judicial powers extend over the three dep ments of the Dauphiné province. The command of Alpine lines of communication always given Grenoble importance from the strategic point of view: the town is a t military capital. As an intellectual center Grenoble is chiefly remarkable for the ra advance made during the last twenty years. The policy of attracting foreign stude to the university has been successful to a high degree. Allied with it is a simi policy relating to the tourist, wherein Grenoble owes no little to its ancient vantage a passageway to the mountains. Commercially Grenoble figures most prominently an importing center for a region which makes considerable demands on the outs world for foodstuffs as well as for raw materials of industry. Unfortunately, co mercial transit is not well developed in the Dauphiné. In this respect Grenoble's sph of influence is especially limited in the south and east. North and west, while tra portation facilities are better, the potency of regional control is limited by the comp tion of the great center of Lyons.

ASIA

Irrigation in Mesopotamia. Writing in the *Near East* for September 29 a October 6, 1916, Sir William Willcocks deals once more with the problem of t restoration of Mesopotamia's ancient fertility. He recalls the dependence of Babylon prosperity on the control of the up-stream waters and the custom of all-the-year-rou field-by-field irrigation, a method in contrast with the large-scale, basin type of irri tion practiced in Egypt. The contrast is related to the difference in regimen betw the Mesopotamian rivers and the Nile: the irrigation problems of the former h always been beset by drawbacks unknown in the valley of the "gentlemanly" Nile. T rise of both the Tigris and Euphrates is abrupt and unheralded. The annual floo occurring between the months of March and May, are too late for the winter and t early for the summer crops, and the amount of silt carried at maximum flood is f times as great as that of the Nile. Yet the amount of water that can be ma available is far greater, and the alluvial soil contains as much potash and more nitrog phosphate, and lime than that of Egypt. Of the two Mesopotamian rivers the cont of the Euphrates, successfully managed by the ancients, is relatively easier than t Tigris.

The new plans, while much more extensive than any of the projects dreamt of the ancient rulers, nevertheless differ but little in method, whether in respect of flo control, irrigation, or reclamation. Legends tell us that Marduk, one of the gre Babylonian deities, reclaimed the flooded areas by dividing them into basins surround by dikes. Today it is proposed to divide the swamps and marshes into compartments 12,000 acres and irrigate each one separately. In the upper delta floods will be co trolled by escapes to the desert on old lines and by barrages whence will be created va reservoirs. On resumption of the work commenced before the outbreak of the war so changes will be followed in the details of the original plan (see "The Irrigation Mesopotamia" by Sir W. Willcocks, London, 1911, reviewed in the *Bull. Amer. Geo Soc.*, Vol. 44, 1912, p. 701, and articles by the same author in the *Geogr. Journ.*: "Mesopotamia, Past, Present, and Future," Vol. 36, 1910, and "The Garden of Ed and Its Restoration," Vol. 40, 1912). Discovery of a limestone outcrop, the only sol foundation seen by Willcocks in the whole of Babylonia, will afford a superior site f the upper barrage on the Euphrates. The upper barrage on the Tigris will be modifi on the line of the great Bow River dam at Bassano, Alberta, which appears to be we suited to a shingle foundation.

But behind such questions of detail is an entirely new outlook ou the Mesopotamian stion. Hitherto projects for the revival of the country were based on the assumption t Turkish rule was to continue: plainly this is considered no longer. Under a more ral government, construction, organization, and control can be planned with greater tude. In any event, however, one point of fundamental importance will remaiu hanged. This is the necessity for complete control by a single power of the whole the region from Hit and Samarra to the Persian Gulf and a definite understanding h Upper Mesopotamia as to the division of the low water supply.

POLAR REGIONS

Rescue of the Marooned Men of Shackleton's Ross Sea Party. The rescue Shackleton of the men of his Ross Sea party is reported iu a wireless despatch eived in Wellington, New Zealand, on February 6 from the *Aurora,* the relief ship which he had sailed from that port on December 22 (*New York Times,* February 6, ed on *London Daily Chronicle*). With this final rescue all of the men of Shackleton's nscontinental Antarctic expedition are accounted for. It will be recalled (July, 1916, *view,* pp. 54-57) that Shackleton himself aud five of his men reached the Falkland nds on May 31, 1916, after their ship, the *Endurance,* had been crushed in the ddell Sea, and that, at the fourth attempt, he finally rescued, on August 30, the naining twenty-two men who were marooned on Elephant Island of the South etland group (September *Review,* pp. 231-232). The breaking away on May 6, 1915, the *Aurora,* the vessel of the Ross Sea party of the expedition on the opposite side the Antarctic Continent, had left ten men stranded there (May, 1916, *Review,* 378). It was to rescue these men that Shackleton had set forth in December from w Zealand. Unfortunately, in their isolation of twenty months, three of the party l died, A. P. Spencer Smith, Victor G. Hayward, and Captain Mackintosh, the leader.

Details of their hardships are given in a message from Shackleton to the *London ily Chronicle* (summarized in the *New York Times* of February 12). The task of Ross Sea party, it will be remembered, was to lay depots on the Ross barrier ice the use of Shackleton's party when it came down from the Antarctic plateau on its y overland from the Weddell Sea. In spite of their abandonment they set resolutely work. In October, 1915, six of them, headed by Captain Mackintosh, left Cape ans, on the iuner side of Ross Island (77¾° S.). The last depot was laid at Mt. pe (83½° S.), at the foot of Beardmore Glacier, one of Scott's depots. Here two of sledges were found—the only traces of Scott's expedition they came across. On the urn journey in January scurvy attacked the party. The Rev. Spencer Smith became helpless that he had to be lashed to a sledge in a sleeping bag. When they were ly eleven miles from Bluff depot (79° S.), the party was overtaken by a furious zzard, which raged from February 17 to March 1. The temperature was —30° F. el and provisions were by this time practically exhausted. After camping for six days, party on February 23 started through the blinding storm to attempt to reach the pot. Soon after starting, Mackintosh fell in his tracks, having reached the limit of man endurance. He was left with Smith, and with Wild to look after them both, ile Joyce, Richards, and Hayward with four starving dogs struggled on to reach the pots. In a momentary clearance of the storm on February 26 the depot was sighted. e party immediately returned to their comrades with food and oil. On the way Hay-rd broke down. Mackintosh and Smith were helpless; they were lashed to a sledge, d, with Hayward staggering along beside them, the party started homeward. At st the party was helped by a sledge sail, but on March 7 the wind dropped, and the il became useless. Three men pulling now were unable to move the sledges, burdened th their sick comrades. Mackintosh, seeing the gravity of the situation, unselfishly cided to remain behind, so as to give the other sick men a chance to reach safety. ey left him in a tent with three weeks' provisions on March 8, forty miles from fety. The party pushed on with Hayward and Spencer Smith, all now weakening om the scurvy. Spencer Smith died on March 9, after forty-seven days' illness. He is cheerful to the end. On March 11 Hut Point, on the southwestern corner of Ross land, was reached, and fresh meat and dried vegetables were procured. Three days terward Joyce, Richards, and Wild started back to get Mackintosh. This they suc-ssfully accomplished, and by March 18 all were safe at Hut Point.

After having survived the hardships of the 800-mile journey to the foot of Beardmore lacier and back, Mackintosh and Hayward succumbed on the short 15-mile journey ross the sea ice from Hut Point to Cape Evans. They left the former camp on May 1916, in fine weather but were overtaken by a sudden blizzard. When their anxious mpanions started after them, their tracks were found to terminate abruptly in open

water. There is no doubt that the two men were lost when young ice broke loose un the influence of the blizzard.

Such were the fortunes of Shackleton's expedition. That he was able to bring b all but three of his men is further striking evidence of his extraordinary energy indomitable spirit. England has every reason to be proud of her Polar record; o more, in the words of Captain Scott's immortal "Message to the Public," it has b shown "that Englishmen can endure hardships, help one another, and meet death w as great fortitude as ever in the past."

PHYSICAL GEOGRAPHY

Twilight. Much popular interest attaches to the intensity and duration of twilig and there is a good deal of misconception and confusion in regard to the mat Professor H. H. Kimball has recently reviewed the literature on the subject, and prepared a working bibliography, which will be useful to those who desire furt information (*Monthly Weather Rev.*, November, 1916). The author has also inclu the results of recent photometric measurements of the intensity of twilight. *Astronomi* twilight has, from an early date, been considered to end in the evening and to be in the morning when the true position of the sun's center is 18° below the horizon, which time stars of the sixth magnitude are visible near the zenith and generally th is no trace on the horizon of twilight glow. On the other hand, *civil* twilight ends in evening and begins in the morning when the true position of the sun's center is below the horizon, at which time stars and planets of the first magnitude are j visible.

The same number of the *Monthly Weather Review* contains translations of Bezold's classic description of twilight (from Pernter and Exner's "Meteorologis Optik"), of Mairan's description of anti-twilight (1754), and of Heim's explanati of the western purple light and the eastern afterglow. R. DeC. Ward

Variations in Solar Radiation and Climatic Changes. The annual report (J 30, 1916) on the work of the Astrophysical Observatory of the Smithsonian Instituti mentions several matters of interest to those who are concerned with problems climatic "changes" and their causes. Observations made with a silver-disk pyrheliome at the Harvard College Observatory in Arequipa, Peru, since August, 1912, have b reduced and published (*Smithsonian Misc. Colls.*, Vol 65, No. 9, 1916). The solar-c stant values from the Arequipa observations confirm the variations of the sun obser at Mount Wilson by the complete spectrobolometric process. There is no evide from the Arequipa records to suggest that the Katmai eruption of June 6, 1912, produ any turbidity of the atmosphere south of the equator. The Mount Wilson observati of 1913-1914 have been reduced and a preliminary publication has been made (*Smi sonian Misc. Colls.*, Vol. 66, No. 5, 1916). The results show distinctly that the avera distribution of solar radiation over the solar disk varies from year to year. Chang also occur from day to day.

A new instrument, the *pyranometer*, has been devised by Messrs. Abbot and Aldri capable of measuring accurately the intensity of sky light by day and of radiation o ward toward the whole sky by night (*Smithsonian Misc. Colls.*, Vol. 66, No. 7, 1916). allotment has been made from the Hodgkins Fund for the purpose of duplicating t solar-constant work of Mount Wilson "at the most favorable station on the earth An expedition to carry on this work will go out in the summer of 1917, probably South America. The plan is to have observations made at the new station and at Mou Wilson for several years, for the purpose of making full and accurate determinations solar variations for comparison with climatic changes on the earth's surface.

R. DeC. Ward.

GEOGRAPHICAL NEWS

Personal

Dr. Frank D. Adams of McGill University read a paper at the thirty-fifth meeti of the Royal Society of Canada, held at Ottawa at the end of last year, entitled "T Quantitative Study of Climatic Factors in Relation to Plant Life."

Dr. W. S. Cooper of the University of Minnesota gave a lecture before the Ge graphic Society of Chicago on February 23 entitled "The Vegetation of the Glaciers Alaska." Dr. Cooper's paper on a similar topic before the Association of Americ Geographers in December last was referred to in the February *Review* (p. 142).

Mr. Harry A. Franck, author of "A Vagabond Journey Around the World," gave cture on March 7 before the Geographical Society of Philadelphia entitled "Tramp-Down the Andes: Incidents of a 2,400-Mile Foot Journey from Bogotá to Cuzco via to."

Dr. Roland M. Harper read a paper before the Torrey Botanical Club of New York February 28 on "Two Long Island Peat Bogs."

Mr. Wyatt Malcolm, at the thirty-fifth meeting of the Royal Society of Canada, l at Ottawa at the end of last year, presented an outline of the bibliography of adian geology for the year 1915.

Mr. J. B. Tyrrell read a paper at the thirty-fifth meeting of the Royal Society of ada, held at Ottawa at the end of last year, entitled "Notes on the Geology of the son and Hayes Rivers, Manitoba."

Mr. James White of the Conservation Commission of Canada read a paper at the ty-fifth meeting of the Royal Society of Canada, held at Ottawa at the end of last :, entitled "Place Names in the Southern Rockies [of Canada]."

Obituary

Dr. F. J. H. Merrill died in Los Angeles on November 29, 1916, in his fifty-fifth :. From 1894 to 1904 Dr. Merrill was director of the New York State Museum at any and from 1899 to 1904 state geologist of New York. Since 1904 he had been aged in private practice. Dr. Merrill is best known to geographers through the sometric map of New York State, 1:760,320, which was published in 1901 under direction.

Professor Henrik Mohn, professor of meteorology at the University of Christiania, l on September 12, 1916, at Christiania, aged eighty-one years. For many years he been director of the Norwegian Meteorological Institute; in 1882 and 1883 he was harge at Bossekop, the Norwegian station forming a part of the international sys- to study Arctic meteorology in those years. Professor Mohn's best-known work 'Grundzüge der Meteorologie," 5th edit., Berlin, 1898. Other important works are: 'Norwegische Nordmeer-Expedition: Resultate der Lothungen und Tiefseetemperatur-bachtungen, *Ergänzungsheft No. 63 zu Petermanns Mitt.*, Gotha, 1880; Die Ström-en des europäischen Nordmeeres, *Ergänzungsheft No. 79 zu Petermanns Mitt.*, ha, 1885; "The North Ocean: Its Depths, Temperature, and Circulation," 1887; senschaftliche Ergebnisse von Dr. F. Nansens Durchquerung von Grönland, 1888 th Nansen), *Ergänzungsheft No. 105 zu Petermanns Mitt.*, Gotha, 1892; and his dis-ions of the meteorology of the Nansen and Sverdrup expeditions (*The Norwegian th Polar Expedition, 1893-1896: Scientific Results,* Vol. 6, 659 pp., London, etc., 5; *Report of the Second Norwegian Arctic Expedition in the "Fram," 1898-1902, 4,* 399 pp., Christiania, 1907).

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

United States

North-Central States

Jenks, A. E. **Indian-white amalgamation: An anthropometric study.** 24 diagrs., ills. *Univ. of Minnesota Studies in Social Sci. No. 6.* Minneapolis, 1

The government act of 1906 authorizing mixed-blood Indians on the White Reservation, Minnesota, to dispose of their allotted lands led to many cases of susp fraudulence and imposition. Investigation necessitated a knowledge of the status of the Indians involved. Mere physical appearance and verbal testimony p unsatisfactory and the use of anthropometric methods was proposed. The India question belong to the Ojibway tribe that since the mid-seventeenth century has more or less with the French and Scotch fur traders coming into the tribal terr The usual measurements have been taken and tabulated for over 300 Indians of and mixed race and compared with measurements of Minnesota French and Scotc of other Indian tribes. The average face-breadth and head-breadth index for pure Ojibway men is 97.19, a value on the same order as that, 98.63 per cent, obtaine Hrdlička for the Pimas, who are probably the purest blooded Indians now existi the states. For the Minnesota French the value is 90.85 per cent and for the S 90.34 per cent. Median values are obtained according to the proportion of mixed bl

Martin, Lawrence. **The physical geography of Wisconsin.** xxii and 549 pp.; diagrs., ills., bibliogr., index. *Wisconsin Geol. and Nat. Hist. Survey Bull. No Educ. Series No. 4.* Madison, 1916.

One of the best of the state reports of similar character written in recent y thorough, modern, well-illustrated, a reliable source of scientific information, and full bibliographic references. The map of the glacial centers and limits, Figure 27, noteworthy improvement over older representations. For example, the British Colu region is designated not "Cordilleran Ice Sheet" but "Valley and Piedmont Intermont Glaciers." The older title has persisted in spite of a wealth of cumul reasons against it. Even so modern and otherwise excellent a text as Pirsson Schuchert's "Text-book of Geology," 1915 (Fig. 511), uses the old form.

The section on the Lake Superior Lowland is especially interesting (Fig. 1). will be recalled that the great depth of Lake Superior, 1,008 feet, or 400 below sea-level, the steep scarp on its northwestern border, the youthful drainag the scarp, and the old erosion surface of the upland on the west form a grou anomalous features that have been highly puzzling to physiographers for many y Martin concludes that the floor of Lake Superior is the surface of a down-sunken and that the steep bordering walls are strongly modified fault scarps (fault-line sca that were developed after the peneplane of the uplands. The valley produced by d faulting was then filled with sediments and later exhumed by glaciers and str influenced in their action by the contrast between the softer sediments of the d sunken block and the hard rock of the border.

The sections on glaciation are the best in the book. Plate X with its two stri photographs furnishes a comparison of present Alaskan with past Wisconsin ice c tions that should be in every text-book. The same may be said of Plate VII, sho the driftless area at the Wisconsin stage of glaciation.

There ought to be so strong a demand for this book in the schools of Wisconsin several editions would be called for. If this hope is realized certain sections shoul rewritten: "The Upland is a Cuesta Rather than a Peneplain," pp. 63-64, illustr the point. Contour maps never show sky lines; and the fact that certain topogra features are quite as characteristic of cuestas as of peneplanes does not in itself vi the peneplane theory. An older theory is not overthrown by finding a new one jus good.

SOUTH AMERICA

Ecuador, Peru, Bolivia

[?]rdenskiöld, Erland. **Incallacta, eine befestigte und von Inca Tupac Yupanqui angelegte Stadt.** Maps, diagrs., ills. *Ymer,* 1915, No. 2, pp. 169-185.

Incallacta is one of a growing number of places studied by Dr. Nordenskiöld and c ers in which the excavation of ruins has enlarged our knowledge of Inca civilization a its extent. The paper is accompanied by a sketch map showing the location of s eral ruins in the valley of the Rio Grande, southeast of Cochabamba, Bolivia. There a also restorations and photographs of ruined walls. The author's conclusions are i eresting. He believes that the ruins of Incallacta were not built later than 1464, l ing his conclusions upon the pottery unearthed and from documentary accounts, i uding Sarmiento de Gamboa (Richard Pietschmann). He believes that the place v built by the Inca Tupac Yupanqui and notes especially the strong resemblance l ween the type of architecture employed and that displayed in the famous fortress c Sacsahuaman at Cuzco, though this resemblance is not at all brought out in the p tographs of ruined walls that accompany the paper. There is a reference to Machu-l chu and to the resemblance between the artefacts of that place and those of the I and of Titicaca believed by Bandelier to be entirely of Inca origin. But the con-c sions of Nordenskiöld must be held in abeyance until the final report of the Peruvian e editions on the entire collection of pottery and other archeological material.

—— **Andes, Copper mining at the top of the.** Ills. *The South American,* Vol. 5, 1 6, No. 1, pp. 18-19. [Morococha, 14,000 feet above the sea.]

Bingham, Hiram. **Further explorations in the land of the Incas: The Peruvian** [E]**pedition of 1915 of the National Geographic Society and Yale University.** [Ma]ps, ills. *Natl. Geogr. Mag.,* Vol. 29, 1916, No. 5, pp. 431-483. [Abstracted in the [Dec]ember, 1916, *Review,* p. 466.]

—— **Bolivia, El estaño de, en los Estados Unidos.** Ills. *Bull. Pan American* [Un]*ion,* Vol. 42, 1916, No. 4, pp. 473-491. [Version of article in English appearing in [Bu]*ll. Pan American Union,* Vol. 42, 1916, No. 2, pp. 182-202.]

—— **Bolivian exports increase [for 1915].** *The South American,* Vol. 4, 1916, [No]. 8, p. 187.

—— **Bolivian tin industry, The.** Ills. *The South American,* Vol. 4, 1916, No. [?] pp. 330-331.

Cook, O. F. **Staircase farms of the ancients.** Ills. *Natl. Geogr. Mag.,* Vol. 29, [191]6, No. 5, pp. 474-534. [For comment see the note on Professor Bingham's "Peruvian [Ex]pedition of 1915" in the December, 1916, *Review,* p. 466.]

Crawford, M. D. C. **The master weavers of the desert empire.** Ills. *Harper's* [Ma]*g.,* No. 794, Vol. 133, 1916, pp. 287-297. [The textile art of old Peru: a popular [pre]sentation of technical studies carried out by the American Museum of Natural [Hi]story.]

Duerr, F. D. **Three thousand miles up the Amazon.** Ills. *Bull. Pan American* [Un]*ion,* Vol. 43, 1916, No. 4, pp. 437-452. [The termination of the journey here described [is] Riberalta, one of the leading towns of Eastern Bolivia. It was established after [He]ath's exploration of the Beni in 1881 and although growth was interrupted by the [rev]olution of Acre it is now estimated to contain 3,500 to 5,000 inhabitants. Japanese [for]m an important element of the population. They are engaged in farming and some [hav]e contracted themselves as laborers to the rubber agencies.]

AFRICA

Atlas Region

—— **Alcázarquivir, La población de.** *Rev. de Geogr. Colon. y Mercantil,* Vol. 13, [19]16, No. 4, pp. 133-134. Real Soc. Geogr., Madrid. [Abstract of census published [Ap]ril 25 in *Boletín oficial de la Zona de influencia española en Marruecos.*]

Barbizet, Jean. **Nos grandes colonies et la guerre: Tunisie.** *Revue des Sci.* [Po]*lit.,* Vol. 35, 1916, Apr. 15, pp. 172-185.

Ben Danou, C. **Contribution à l'étude de l'industrie pastorale en Algérie:** [Le]**s nappes d'halfa et de leur rôle au pays du mouton; Utilisation du bolus** [d'h]**alfa.** *Bull. Trimestriel de la Soc. de Géogr. et d'Archéologie d'Oran,* Vol. 38, 1915, [No]s. 3-4, pp. 304-317.

Blake, Maurice. **Morocco.** 8 pp. *Suppl. to Commerce Repts.*, Ann. Series, 1 No. 75a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washing D. C.

Bonelli, Emilio. **Cabo Yubi.** *Rev. de Geogr. Colon. y Mercantil*, Vol. 13, 1 No. 6-7, pp. 245-247. Real Soc. Geogr., Madrid. [Commercial and political significa of this important coast station in relation to Spanish Morocco and the Canaries.]

Dantín, Juan. **Las tierras negras de Marruecos.** *Trabajos del Museo Nacl. Ciencias Nat., Ser. Geol., No. 13*, pp. 27-37. Madrid, 1915. [See reference in Decem *Review* under "The Southwesternmost Black Soils of Europe," pp. 468-469.]

—— **Front marocain, Sur le, mai-juin 1916.** *L'Afrique Française*, Vol. 26, 1 No. 7, pp. 246-252.

Gentil, Louis. **La recherche scientifique au Maroc.** 27 pp. Reprint from *Re Gén. des Sci.*, April 15, 1914.

Gentil, Louis. **Le Maroc: Sa pacification; Son outillage économique; développement de ses échanges.** Map. *Bull. Mensuel Fédération des Industriels des Commerçants Français*, No. 128, Vol. 11, 1914, No. 8, pp. 270-274.

Gentilli, Nino. **Nuovi centri commerciali al Marocco.** *L'Africa Italiana*, 35, 1916, No. 5-6, pp. 101-112.

Gentilli, Nino. **Vecchi e nuovi interessi italiani al Marocco.** *L'Africa Italia* Vol. 35, 1916, No. 9, pp. 193-208.

Hérelle, F. d'. **La campagne contre les sauterelles en Tunisie en 1915.** *B Soc. Pathol. Exot. de Paris*, Vol. 8, 1915, No. 9, pp. 629-633. [Title taken from *Rev of Applied Entomology*, Vol. 4, Series A: Agricultural, 1916, Part 2, p. 44.]

Hooton, E. A. **Preliminary remarks on the archeology and physical anthrop ogy of Tenerife.** *American Anthropologist*, Vol. 18, 1916, No. 3, pp. 358-365.

La Salle, d'Anfreville de. **Le Maroc pendant la guerre.** Map. *La Géo* Vol. 30, 1914-15, No. 4, pp. 311-319. Paris.

Le Clay, Capitaine. **Causerie sur les populations berbères du Maroc.** *Rensei Colon. (Suppl. à l'Afrique Franç.)*, 1915, No. 5, pp. 141-148.

—— **Maroc, La colonisation au.** *Renseign. Colon. (Suppl. à l'Afrique Fran* 1916, No. 7, pp. 209-211.

Stiles, G. K. **Canary Islands.** 10 pp. *Suppl. to Commerce Repts.*, Ann. Se 1916, No. 15a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Wa ington, D. C. [The United States, Argentina, and Cuba have made important ga in the import trade of the Canary Islands. The two latter countries have likewise b recipients for a proportionally large number of emigrants from the islands.]

—— **Tunisia: I fosfati di Gafsa; La campagna olearia 1915-1916.** *Rapporti RR. Agenti diplomatici e consolari N. 1.*, pp. 4-5. Direz. Gen. degli Affari Com Minist. degli Affari Esteri, Rome, January, 1916.

Wolff, Karl. **Geomorphologische Beobachtungen an der Küste des östlich Algeriens.** Ills. *Mitt. der Gesell. für Erdkunde zu Leipzig für das Jahr 1913*, pp. 1 134.

PHYSICAL GEOGRAPHY

Hydrography and Oceanography

Berget, Alphonse. **Les mines flottantes et les courants marins.** Maps, dia *La Nature*, No. 2226, 1916, May 27, pp. 345-348. [See December, 1916, *Review*, 471-472.]

Defant, A. **Theoretische Überlegungen über Seespiegelschwankungen in Se und Meeresbuchten.** Diagrs. *Annal. der Hydrogr. und Marit. Meteorol.*, Vol. 1916, No. 1, pp. 29-34.

—— **Instrument plots profiles of river and harbor beds.** Ills. *Engineeri Rec.*, Vol. 74, 1916, No. 4, p. 109.

Jones, E. L. **General tide tables for the year 1917.** 488 pp.; diagrs. *U. S. Co and Geodetic Survey Ser. No. 42.* Washington, D. C., 1916.

McGrath, P. T. **The international ice patrol.** Ills. *Amer. Review of Revie* Vol. 54, 1916, No. 3, pp. 305-308.

Newbigin, M. I. **The geographical treatment of rivers.** *Scottish Geogr. Ma* Vol. 32, 1916, No. 2, pp. 57-69.

—— **Oceanic tides, with special reference to the work of the United Stat**

ast and Geodetic Survey. Diagr. *Sci. Amer. Suppl.*, No. 2111, Vol. 81, 1916, e 17, p. 398. ["From an address by Dr. Charles Lane Poor at the Centennial Exers of the United States Coast and Geodetic Survey."]

OLMSTED, F. H. **Control of mountain torrents by check dams.** Ills. *Engineer- News*, Vol. 75, 1916, No. 7, pp. 314-315.

—— **Tide-predicting machine No. 2, U. S. Coast and Geodetic Survey, scription of the.** 35 pp.; diagrs., ills. *U. S. Coast and Geodetic Survey Special ol. No. 32.* Washington, D. C., 1915.

Meteorology and Climatology

ABBOT, C. G., AND L. B. ALDRICH. **The pyranometer—an instrument for meas- ng sky radiation.** 9 pp.; diagrs. *Smithsonian Miscellaneous Colls.*, Vol. 66, 1916, 7. [See reference, above, on p. 246.]

AITKEN, JOHN. **The dynamics of cyclones and anticyclones.** *Proc. Roy. Soc. of nburgh*, Vol. 36, 1915-16, Parts 1-2, pp. 174-185.

BEALS, E. A. **Droughts and hot weather.** Bibliogr. *Monthly Weather Rev.*, Vol. 1916, No. 3, pp. 135-138. ["Extracts from paper, 'Forecasts of Weather Favor- to the Increase of Forest Fires,' read before the Pan-American Scientific Congress Washington, D. C., Dec. 30, 1915."]

BIRKINBINE, C. P. **Variations in precipitation as affecting water works engi- ring.** Maps, diagrs., ills. *Journ. of the Amer. Water Works Assoc.*, Vol. 3, 1916, 1, pp. 1-62.

BONACINA, L. C. W. **On the re-adjustment of pressure differences: two species atmospheric circulation and their connection.** Diagrs. *Quart. Journ. Roy. eorol. Soc.*, No. 180, Vol. 42, 1916, pp. 209-228. [Discussion, pp. 225-228.]

BROOKS, C. F. **Notes on meteorology and climatology.** *Science*, Vol. 43, 1916, e 30, pp. 933-937.

BROOKS, C. F. **Notes on meteorology and climatology: Snowfall and snow er.** *Science*, Vol. 43, 1916, Feb. 11, pp. 212-214.

CLAYTON, H. H. **Relation between rainfall and synoptic winds.** *Monthly ather Rev.*, Vol. 44, 1916, No. 2, pp. 80-81.

D[INES], J. S. **Atmospheric pollution.** *Monthly Weather Rev.*, Vol. 44, 1916, 3, p. 114. [Reprinted from *Science Abstracts*, Sect. A, Feb. 28, 1916.]

DINES, J. S. **The mounting and illumination of barometers and the accuracy ainable in the readings.** Ills. *Quart. Journ. Roy. Meteorol. Soc.*, No. 177, Vol. 42, 6, pp. 1-8.

DINES, W. H. **Circulation and temperature of the atmosphere.** *Monthly ather Rev.*, Vol. 43, 1915, No. 11, pp. 551-556.

GUILBERT, GABRIEL. **Forecasting thunderstorms.** *Monthly Weather Rev.*, Vol. 43, 5, No. 11, pp. 556-559. [Translated from *Compte Rendu de l'Assoc. Franç. pour vancemt. des Sci., 41ème Session, Nîmes, 1912*, Paris, 1913, pp. 296-304. Followed . 559-562) by a translation of M. Durand-Gréville's rejoinder, *Notes et Mémoires l'Assoc. Franç. pour l'Avancemt. des Sci., 41ème Session, Nîmes, 1912*, Paris, 1913, pp. -291.]

KADEL, B. C., AND CLEVELAND ABBE, JR. **Water-evaporation studies by [the] eather Bureau.** Ills. *Engineering News*, Vol. 76, 1916, Aug. 3, pp. 200-201.

KIMBALL, H. H. **Daylight illumination, and the intensity and duration of light.** 16 pp.; ills., bibliogr. ["A paper read at a meeting of the Pittsburgh sec- of the Illuminating Engineering Society, Cleveland, Ohio, February 18, 1916." also note, above, on p. 246.]

LIPMAN, C. B., AND D. D. WAYNICK. **A detailed study of effects of climate on portant properties of soils.** Ills., bibliogr. *Soil Science*, Vol. 1, 1916, No. 1, 5-48.

LITRE, —. **La science de l'air, notions nouvelles et utilisations.** *Bull. Soc. de gr. de Toulouse*, Vol. 34, 1915, No. 3-4, pp. 206-211.

LONGSTRETH, T. M. **Reading the weather.** 195 pp.; ills. Outing Publishing Co., v York, 1915. 70 cents. 7 x 5.

—— **Meteorological Committee, Tenth Annual Report of the, for the year led 31st March, 1915.** 93 pp.; diagrs., ills., index. London, 1915.

SANDSTRÖM, J. W. **Working up of wind observations.** Map, diagrs. *Monthly ather Rev.*, Vol. 43, 1915, No. 11, pp. 547-551.

HUMAN GEOGRAPHY

General

HUNTINGTON, ELLSWORTH. **Civilization and climate.** xii and 333 pp.; maps, dia index. Yale University Press, New Haven, 1915. $2.50. 9½ x 6½.

Dr. Ellsworth Huntington's studies of the changes which have taken place in climate of the past, particularly in Palestine and in the arid regions of the western Un States, are familiar to the readers of the *Geographical Review*. The present vo is a contribution to the problem of the effect of climatic conditions upon hu efficiency and the development of civilizations.

In essence Dr. Huntington's thesis is that we must recognize in the life of nat as we recognize in agriculture, not only hereditary stock and artificial culture but climatic conditions; and he supports this plausible but commonly neglected viewp by two new lines of statistical evidence.

The first, and in some respects the most important, body of data presented with the variations in individual efficiency at different seasons, as measured by wages of factory operatives employed on a piece-work basis, and by the scholastic rec of students at West Point and Annapolis. It is impossible here to go into the de of the methods used, and in fact Dr. Huntington only presents the general results somewhat popular form and without the detailed tables which one may hope wi fully presented elsewhere. In general, however, it may be said that the trades ch were so far as possible free from fluctuating seasonal demands or disturbing fa other than those of varying human efficiency. The summary curves presented agre showing two points of maximal efficiency for the factory operatives, in the spring in the fall, with marked depressions in winter and summer. The winter drop is more marked than the summer drop in the Connecticut factories studied, while in S Carolina and Georgia cotton factories the winter and summer minima are about e and Florida cigar makers show a deep summer depression with none in winter. curves for the daily marks of students at West Point and Annapolis show the phenomena as those for Connecticut factory workers, except that the spring maxi comes earlier (in March or April instead of June). The author concludes, fro comparison of his figures with data for temperature, that the maximum of phy efficiency is manifest when the outdoor temperature is 60°-65° and that for m efficiency when it is 40° F.

Dr. Huntington also analyzes his data with respect to the constancy of tempera from day to day and concludes that a change, either a rise or fall in temperatur favorable to efficiency. The differences here are very slight and the reviewer is convinced that they are significant. The conclusion which the curves seem most cl to warrant is that a moderate drop in temperature of 5°-10° exerts a stimulating eff

The second quite distinct line of evidence presented deals with a broader prob the world distribution of climates and civilizations. Here again Dr. Huntingt methods are not given in sufficient detail for critical analysis. In general, howe he has graded the principal regions of the earth's surface according to their approx tion to an ideal climate (moderate temperature with stimulating influence of cha ability and storminess), and has then graded the civilization of the same regions acc ing to a score card submitted to a group of fifty scientific men and publicists in var countries (mostly from the United States and Europe). The maps prepared for cli show ideal conditions in west-central Europe and in a belt extending across cen North America from the east coast to the Rockies, with Japan, New Zealand, south most South America, and the west coast of North America coming next in order. maps for civilization correspond in a striking way to those for climate.

Dr. Huntington summarizes in his last four chapters much of his earlier work the evidence for pulsatory variations in the climate of the past as indicated by studies in Palestine, by measurements of the growth rings of the great trees of C fornia, by the records of the ancient Maya civilization and by the evidence of cer salt lakes in the west. In general, the evidence of the past, as of the present, bears his contention that climate is a real and important factor in human progress. " hypothesis, briefly stated, is this: Today a certain peculiar type of climate pre wherever civilization is high. In the past the same type seems to have preva wherever a great civilization arose. Therefore, such a climate seems to be a neces condition of great progress."

This is a very stimulating and original book. It should open up important new f for fruitful research; and its conclusions have a far-reaching practical significance. triumphs of sanitation have made it clear that life may be made as safe in the tr as in the temperate zone. It may well be, however, that there is a wide gap betw survival and efficiency, and that a very hot or a very cold or a very even climate is in a serious bar to the release of the highest energies of the human race.

C. E. A. WINSLO

THE
GEOGRAPHICAL REVIEW

OL. III APRIL, 1917 No. 4

PRESENTATION OF THE DAVID LIVINGSTONE CENTENARY MEDAL TO COLONEL THEODORE ROOSEVELT

At the regular monthly meeting of the American Geographical Society March 20 in the Engineering Societies' Building, 29 West Thirty-nth Street, Colonel Theodore Roosevelt was presented with the David vingstone Centenary Medal. This gold medal was founded in 1913 by e Hispanic Society of America. It is awarded by the American Geo-aphical Society of New York and since its foundation has been presented but one other explorer, Sir Douglas Mawson.

President Greenough presided and on presenting the medal made the llowing remarks:

Ladies and Gentlemen, Fellows of the Society:

"The occasion on which we meet tonight is one of great interest and made all the more notable by the presence of His Excellency the Brazilian mbassador and other distinguished guests who have honored us by their tendance and whom I welcome in your name.

"A well-known feature of the form of government in the United States ovides that the incumbent of any office—no matter how exalted—when-er his public employment has ceased, shall resume his station as a plain izen of the Republic, without insignia or any artificial endowment to stinguish him from his fellows. Therefore I, as your representative, am rmitted on this occasion to forget for a moment the great part which r guest has played in the history of our nation and to address him solely a co-worker in the field of science to which our Society is dedicated. iat he should have found time throughout many years of engrossing res of international importance to pursue earnestly the geographical bors with which his name is associated is evidence of his devotion to the use; and his accomplishment as explorer, writer, and speaker bears

witness to the breadth and solidity of his geographical knowledge. T Society seeks by the bestowal of its enduring memorial to record its live appreciation of the important service which he has rendered. His journe have covered both South America and Africa, so that there seems a especial fitness in the title of the medal awarded to him. It is designat the David Livingstone Centenary Medal and was founded by the Hispar Society of America on the one hundredth anniversary of the birth of th great pioneer and explorer, in accordance with the legend inscribed up it. This reads in part:

TO BE AWARDED BY
THE AMERICAN GEOGRAPHICAL SOCIETY
OF NEW YORK
FOR SCIENTIFIC ACHIEVEMENT IN THE FIELD OF
GEOGRAPHY
IN THE
SOUTHERN HEMISPHERE

"The Council of the Society feel that the award which they are no making to our guest of the evening complies eminently with the terms the foundation. His explorations in South America and Africa and l illuminating interpretations of the life of the pioneer upon many of t world's great frontiers sufficiently establish his reputation as a geographe and his unequaled influence with the youth of the country has won t attention of thousands amongst them to the inviting field of explorati and geographical research.

"And now, Colonel Roosevelt, in behalf of the Council and Fellows the American Geographical Society, I hand you this gold medal in tok of their recognition of your distinguished contributions to geographic science; and in so doing I may be allowed to express the pleasure felt l the Society in the association of its name with your own in this memori Finally I desire to convey to you an expression of personal regard an admiration from our many members and their hope that you may be lon spared to inspire by your example and teaching a fervent and undivide Americanism throughout our land."

Colonel Roosevelt replied in part as follows:

"I very deeply appreciate the signal honor conferred on me by t American Geographical Society. There is no other recognition that cou be given me by any scientific or literary body which I should value much as I do the medal you have awarded me. I thank you with all m heart. You have made me very proud.

"Having said this; having, I trust, shown you how deeply I value an appreciate your action, I am sure that you will pardon me for saying th if I had been consulted before you made the award, I should have aske you as a matter of justice to confer this medal on Col. Candido Rond

Brazil. During the last ten years, aside from polar exploration, the st important, most difficult, and most hazardous work in exploration and d geography, the work most fruitful in results alike from the standnt of the scientific geographer and of the explorer, has been that done Colonel Rondon at the head of the Brazilian Telegraphic Commission. e expedition which I had the honor to command—Colonel Rondon being ociated with me—during the early months of 1914 was rendered possible y by the hard and perilous work done by Colonel Rondon and his assotes of the Brazilian Telegraphic Commission during the preceding seven ırs in the then unexplored wilderness of Matto Grosso. We merely put cap on the pyramid which had thus been erected. I wish also to express heartiest appreciation of the generosity of the Brazilian Government. e expedition was rendered possible only by the more than open-handed port given it by the Government of Brazil.

"At the opening of the present decade, the second decade of the ntieth century, hardly any other region in the world of like extent was nearly a blank, from the standpoint of the cartographer, as that portion the western basin of the Amazon which stretches from the highland ide of central Brazil north to the mighty river itself. For two or three turies the men who went up and down the Amazon and its main affluent, Madeira, had known and named the mouths of the chief rivers running o them. But nothing whatever was known of the source, length, and ırse of certain of these rivers; just as the lower Nile was known for eral thousand years before its upper course was explored and put on map by Speke, Grant, and Baker. The Brazilian Telegraphic Commisn, in working westward along the great Matto Grosso divide or water-d, had come across several streams running northward into the unknown derness over which the equatorial forest lay like a vast green shroud. I ided to explore the largest of these, so as to see whether there was not ne affluent of the lower Madeira, or of the Amazon near the mouth of Madeira, of a size and importance hitherto undreamed of and not even ted at on any existing map.

"From the headwaters of the Paraguay we crossed, and went along, the hland divide, traveling on mule back for nearly six weeks. On our way passed the headwaters of a stream nicknamed the Pineapple, flowing thward into the unknown; this stream was second in size to the one I nned to go down.

"The exploration proper occupied two months. As a result we put on map a river about the size of the Elbe or the Rhine, of the very existence which the maps had previously given no hint. By turning to the maps ıed before our expedition you will see that various wholly imaginary ers were put down as running almost at right angles across the course ually followed by the river which we descended. This unknown river, ich we thus explored, rises between the 59th and 60th degrees of longi-

tude west from Greenwich, and between the 12th and 13th degrees latitude south, and flows northward between the 60th and 61st degrees longitude west, emptying into the Madeira—of which it is the m important affluent—between the 5th and 6th degrees of latitude south. counted it extraordinary good fortune at this late day in the explorat of the world to take part in such a piece of work. The innumerable rap in the river, the scarcity of food animals and plants in the forests, fact that the country was not healthy, and the neighborhood of wild treacherous Indians added elements of danger to the toil. Three of party lost their lives.

"In latitude 10°58′ we passed the mouth of a big tributary river wh entered from the right, and which we christened the Cardozo. We course knew nothing as to whence this river came, and so could not pu on the map, except only the mouth. But the following year Lieuten de Souza of the Telegraphic Commission, at the head of a party, descen the Pineapple River; and it proved to be the Cardozo. The Indians attac this expedition and killed de Souza and all but three of his men; one the latter returned to camp when the Indians had left and got de Sou diary, which he actually brought in, after being some twenty-three d alone in the wilderness before he reached the first rubberman's camp.

"Your President has been kind enough to refer to me as having sh during my life that I was emphatically an American. I am deeply gr ful. At this time there is no lesson so important to this country Americanism; Americanism of that virile type which disclaims all divi national allegiance and which insists upon those primary virtues that wholly incompatible with the ignoble folly of the professional pacifist. medal is named after David Livingstone, the great missionary explorer. work finally cost him his life; as their work has cost the lives of many o explorers, from Mungo Park to Scott. Livingstone was as just and ge and lovingly tender a man as ever lived; but he was lionhearted, alik his readiness to risk life for a sufficient object and in the flaming indig tion with which he made ready to oppose with force of arms the wrong and the oppressor. He was wholly incapable of the peculiarly offen hypocrisy which stands idly by and utters pious platitudes of senti tality, while triumphant brutality tramples on the unoffending. You this organization set a high value on that work of the explorer whic predicated on willingness to face hazard and jeopardy, and on the s of proportion which refuses to put an overweight on life when bala against worthy achievement. The work to which you give the most ge ous recognition is work which is almost as dangerous as war; work which the service rendered is rendered at the cost of a mortality al as great as in war. This attitude of American geographers towards subject which is their peculiar interest is the attitude which it beho the whole American nation to take as regards the prime duties of nati

fense and international honor. We must put service first—not safety st; and we must act with that lofty and noble idealism which expends elf, not in empty words, but in action which recognizes the elemental :t that those men only are fit to live who are not afraid to die."

The exercises closed with a brief informal address by His Excellency micio da Gama, the Ambassador from Brazil, who was received by the llows of the Society with much enthusiasm. Senhor da Gama expressed eat satisfaction in Colonel Roosevelt's high praise of Colonel Rondon's rk and announced his intention of cabling a message to that effect to his vernment. After reference to Brazil's resources and its prospects for velopment he spoke feelingly of the cordial relations between the governnt of Brazil and that of the United States and particularly emphasized fact that Brazil welcomes the scientific explorer, to whom governmental ilities will always be offered.

UP THE ORINOCO TO THE LAND OF THE MAQUIRITAR

By LEO E. MILLER

It seemed as if the declining sun had set the quivering world aflan all day long the *Delta,* well remembered but unbeloved by voyagers the Master River, had struggled on against the yellow flood toward her g two hundred and forty miles above the Gulf of Paria. Not a ripple stir the placid water, which seemed like molten glass; and no breeze stirred heavy, dark vegetation that lined the river's bank. It had been one those days which only the traveler to tropical lands can adequately pictu when all the earth silently droops in an unrelenting heat and glare a eagerly awaits the coming of night, which alone can bring relief.

As the sun dipped into the forest, and only a faint pink and violet gl lit up the banks of vapors hanging low in the west, the night wind from ocean sprang up; soon a choppy sea was raging, and, as each white-capp wave struck her wooden sides with a muffled boom, the fragile, top-hea steamer shuddered and threatened to capsize. Morning, however, fou her still intact, and, not long after, we reached the high sandy bank which stands Ciudad Bolivar.

The first white man to ascend the Orinoco was Ordaz, who in 1531- went as far as the mouth of the Meta; and after him came the usual bar of treasure seekers in quest of El Dorado, but instead of wonderful gold cities they found yawning graves in a hostile wilderness. Before the mid of the eighteenth century the Jesuit fathers founded missions as far Esmeralda; these have long since vanished. In 1800 Humboldt made memorable voyage to the Cassiquiare, and a number of other scienti expeditions followed in his wake at irregular intervals. For all the wo of the explorers both early and late it is remarkable that even to this d the actual sources of the Orinoco have not been discovered.

To trace this huge artery to its very beginning, supposedly somewh in the Serrania de Parima on the Brazilian frontier, was not the object our expedition. Accompanied by Mr. Francis X. Iglseder of New Yo and under the direction of the American Museum of Natural History started in the fall of 1912 on a zoölogical reconnaissance to the regio north of the inaccurately mapped Rio Cunucunuma, more particula Mount Duida, thought by many to be the locality described in a wid read book entitled "The Lost World." Of this country, the people, and t animal life inhabiting its virgin wilds, very little was known.

With the tying-up of the *Delta* the first stage of our journey had be completed.

Ciudad Bolivar, formerly called Angostura, meaning "narrows," account of the narrowing of the Orinoco at this point to the width of h

. mile, stands on an eminence on the right bank and is the capital of the lepartment of Guiana; it is the largest and the only city of importance on he river. The red-tiled roofs and white-washed walls of the houses can e seen from afar. On landing, one is confronted by a strange medley of ow, thick-walled edifices, narrow, crooked streets, and swarthy, unkempt eople. Practically all of the windows are heavily barred, a custom common

FIG. 1—Sketch-map of the Orinoco River region, showing the location of the geographical features nentioned in the text. Scale, 1:13,700,000.

n many parts of South America, and retained from the time of the Moors n Spain.

Whatever beauty attaches to the place is indoors. There are no green awns or flower gardens to cheer the eye of the passer-by; but a glimpse behind the somber walls will invariably reveal an open court, or patio, containing flowers and tropical shrubbery and occasionally a fountain; but this is not all. In the patio of the hotel which served as our headquarters there lived in perfect harmony several large tortoises, a deer, two sheep, about a dozen tree ducks, turkeys, chickens, guineafowl, and several pigs; while fifteen species of birds, including parrots, orioles, and finches, occupied cages hanging on the walls. The desire to keep caged animals is an inherent

trait of the South American. Back of the city lies an extensive swam from which, at least during the month of December, came great numbers o mosquitoes. As may be inferred, the heat was very great; but regularl at nightfall a strong wind comes up the river, causing a drop of severa degrees in the temperature; then the town casts off its torpor, light twinkle, the band plays on the waterfront, gaily dressed and painted wome peer from behind the heavily barred windows, the streets are filled with roving crowd of men and boys, and Ciudad Bolivar presents a wide-awak appearance.

On the opposite side of the Orinoco is the small town of Soledad; thi village supplies a large portion of the sailors who man the boats plying o the river.

Our first care was to try to find a way of proceeding on our voyag On account of the low stage of the water between January and March steamers do not ascend beyond Ciudad Bolivar regularly and at best the go only as far as the Apure. It was therefore decided to charter a sailboa of shallow draft which would take us to the first great barrier to navigation the cataracts of Atures. To secure such a craft was not an easy matter We visited several of the large export houses, mostly German, but none o them had vessels at their disposal. Finally, we heard of a man named Guillermo Montez. He was a type frequently met with in South America Owning a small store which contained chiefly long ropes of garlic festooned on the walls, living in a mud hovel, and apparently poverty-stricken, h nevertheless possessed great wealth and knew how to handle his fellow countrymen. This "handling" consisted of keeping them constantly i debt to himself so that he owned them virtually body and soul. Monte immediately sent to Soledad for one of his debtors, and within a short tim we had completed the contract for the transportation needed.

On December 16 word reached us that the boat was ready. We had spent the intervening days adding to the stock of provisions brought from New York, and it might be added that the shops of Ciudad Bolivar are wel filled with a splendid assortment of foodstuffs at reasonable prices.

The *Hilo de Oro* (Thread of Gold), for that was the name of the sloop impatiently bobbing near the bank, was a boat capable of carrying one hundred and fifty *quintales* and was under the command of one Pedro Solano; her crew consisted of four men and the captain's wife, whose position was that of cook. Properly to load the equipment and provisions required half a day, and, with the springing up of the evening wind, we hoisted sail and, skirting the towering rocks protruding from the center o the river, glided easily to the other side. As all the men came from Soledad there followed a night of the usual festivities of drinking and leave-taking but with the rising sun, the wind still holding out, we actually started on our voyage up the great river.

Fortunately the wind was favorable and continued to blow intermit-

ntly all day long; by ten o'clock at night we had covered about thirty iles and cast anchor at a point called Boca la Brea. The width of the ver averaged about one mile and half, and the entire bed is strewn with ıge boulders, rendering navigation at night impossible.

Next day a favorable wind did not reach us until late in the morning, ıd we had our first glimpse of wild life. The crew, a piratical-appearing ınd with unshaven faces, wearing short breeches only, and red and blue ındkerchiefs around their heads, landed a number of large striped catfish; ıt their tackle was too light, and others of greater weight broke the lines ıd escaped. Numbers of *caimans,* or crocodiles, floated lazily down stream ith only the eyes and sawlike tails showing above the water; and a school freshwater porpoises jumped and raced around the boat.

On the days that followed the wind either died down entirely or blew ith terrific violence, so that slow progress was made. The *chubascos,* or ıualls, not uncommon on tropical rivers, appear suddenly and without arning; a faint, funnel-shaped mass appears on the horizon, followed by low bank of black clouds, and fitful little sand-spouts spring into existence ı the vast *playas.* There is never time to seek the leeward bank, and not minute is lost in lowering sails and placing every available object below prevent its being washed overboard. While Captain Solano shouted oarse orders and the crew worked like mad (the only time they really did ork), we donned our oilskins and awaited the coming of the storm. To o down into the hatch was impossible, both on account of the lack of space nd the stifling heat. The wait was never very long. With a roar the urricane burst upon the quiet river, and in a few minutes everything was bliterated in the dense fog and wall of falling water. The wind tore ırough the rigging with agonized wails, and angry white-capped waves prang suddenly into existence, sweeping over the boat and dashing it bout like a cork in a mill-race. There is nothing to be done but wait until ıe storm subsides and hope that no obstructing boulder, or the bank, will ut an end to the madly careening craft in the semi-darkness. This may ıst from fifteen minutes to an hour; then the wind dies down, the rain eases, and the fog lifts. A changed river presents itself. Huge waves, apped with foam, dash and tear at the high crumbling banks, undermining ıem so that large sections tumble into the water, carrying with them tall rees and massed vegetation. The agitated surface is littered with débris, hich bears good evidence of the violence of the storm.

After this there followed several days of calm; there was not enough ind to fill the sails, and all the "whistling for a breeze" of the sailors did xactly as much good as one would expect it to. Finally, in desperation, long rope was tied to the mast, and two men, going ahead in a canoe, ıade the other end fast to a tree, a few hundred feet ahead. The remaining ıembers of the crew then hauled on the rope, slowly drawing the boat forard. Progress was slow, of course, but on December 22 we reached the

'uerta del Infierno, the best possible name for the narrow, rocky gorge hrough which the river rushes with uncontrolled fury. A large mass of ranite covered with low vegetation divides the river into two narrow hannels, one of them so protected by high, rocky banks that no wind ever eaches the water and it consequently becomes impossible for boats to sail p the passage. The other is a narrow, rock-strewn gorge down which the vater thunders in a series of cascades. On the right bank, perched high n the rocks, are a few mud huts called Pueblo de las Piedras. We spent he greater part of a day waiting for wind and then made straight for the eething passage. Fortunately our pilot was a good one; his method was o steer directly for some great boulder, below which the water was quiet, nd, just as the ship seemed about to strike, he swung the tiller, and the oat painfully nosed her way up the cataract that dashed down the sides f the rock. If the breeze slackened for a moment, the ship drifted back vith the strong current, which was extremely dangerous, as there was no vay of regulating her course; but always, just in the nick of time, the sails illed, and after an hour's struggle we left the rapids and sailed into the uiet water above.

Not far above the Infierno is the village of Mapire, a neat collection of erhaps fifty huts on a high bluff overlooking the river. Back of the town re vast *llanos,* or grassy plains, which are capable of supporting numerous erds of cattle. On the opposite side of the river, and some little distance p, is the mouth of the Caura, at one time believed to be the home of a ribe of headless people; but the old superstition has been overthrown, and luring the first month of each year many adventurous parties ascend the iver for a considerable distance in search of the *serrapia,* or tonka-bean. The tree (*Dipteryx odorata*) upon which the fruit grows resembles a mango, vith spreading branches and deep, dense leaves. The fruit is also very imilar to the mango, of a greenish color, with tough, fibrous flesh and a arge seed. While the fruit is still unripe great quantities of it are destroyed y macaws and parrots, which take a bite or two, then drop the rest on the round. When ripe, the fruit falls, and it is then gathered into heaps and lried; the seeds are later cracked open and the strong-smelling kernel is xtracted, to be carefully preserved and sent to Ciudad Bolivar, where it is treated in casks of rum and then exported. It is used in making perfumes and for flavoring extracts.

The water of the Caura is of a clear, dark red color, and, for a great distance after entering the Orinoco, the two waters flow side by side without mingling to a perceptible degree.

The Orinoco widens into a majestic stream above this point, and we estimated that the distance from bank to bank must in some places be from three to five miles; also, vast sandbanks stretch along both sides for a distance of many miles.

Some hundred miles farther up stream lies Caicara, the only town of

importance on the Orinoco beside Ciudad Bolivar. At the time of our visit it consisted of about one hundred and fifty houses; but on account of a rubber and *serrapia* boom on the Cuchivero, many of the inhabitants were leaving for the latter place. The next day we passed the mouth of the Apure and, just beyond, the mouth of the Arichuma; a great low, sandy island rises out of the center of the Orinoco at this point, on which thousands of terns, skimmers, gulls, and other water-fowl were apparently nesting. All day long, and even at night, the air was filled with darting, screaming birds that made such a terrific din that it was impossible to sleep. High waves prevented our landing on the island, but the natives visit it regularly, taking away cargoes of eggs; for this reason the island has been named Playa de Manteca.

The next settlement is called Urbana, on the south bank of the river almost opposite the mouth of the Arauca. It consists of about a score of hovels. The Arauca is a river of considerable size and is said to be bordered by vast marshes and swamps, the home of countless egrets and other water birds. Hunting parties ascend during the nesting season and kill great numbers of the birds; the plumes are taken to Ciudad Bolivar and sold to exporters.

Leaving Urbana on December 29, we entered one of the most difficult stretches of the river to navigate. The fish-hook bend of the Orinoco turns southward, and the eastern bank is dotted with a range of low, granite hills which are in fact a chain of giant, blackened, dome-shaped boulders. The wind from the east, roaring through each cleft and opening, strikes the river from several directions and with the violence of a hurricane. One moment there is scarcely wind enough to make headway against the current; the next, a gust strikes the sails and sends the ship wallowing on her beam until the boom drags in the water and it is an even bet if she will gradually right herself or go over. At such times of peril, as well as on starting each morning, it is the custom of the sailors to pray. Of course they are all Catholics. The captain, or whoever steers, says: "*Vamos con Dios*" (let us go with God), and the others answer in chorus "*Y con la Virgen*" (and with the Virgin). Occasionally the person whose duty it is to lead is so occupied in rolling a cigarette or slapping at flies that he neglects his duty; then someone is sure to remind him with a sarcastic "*Aha! Hoy vamos como los Protestantes*" (Aha! today we are starting like the Protestants). It often happens that the crew is remiss. The captain will repeat his lead several times without being heard; finally, his patience exhausted, he shouts at the top of his voice "*Vamos con Dios, caramba!*" and the crew immediately yell back at the top of their voices "*Y con la Virgen, caramba!*"

Added to the danger of shifting gales is a rapid named San Jorge. There was just enough water to cover the rocks which obstruct the river bed, causing a series of cross currents and whirlpools which only a Venezuelan boatman, trusting mainly to luck, can hope to pass through. The rigging

of the *Hilo de Oro* was old and rotten, and ropes were constantly snapping and sails splitting. No matter how obvious a defect might be, it was never remedied until an accident had occurred. The boom had been threatening to break as each sudden gust of wind struck the mainsail, but a few boards nailed across the weakened place, it was hoped, would give sufficient strength for any emergency. An hour after leaving San Jorge, however, the boom parted with a loud report and dropped into the water, nearly upsetting the boat. Then, while the craft wallowed on her side with the deck awash, there ensued a good deal of mingled praying, swearing, and frantic work until the heavy boom was fished out of the water. We tied up at the bank, cut down a tree, and worked the greater part of the night replacing the broken spar.

One of the curious granite battlements rears its head out of the water to a height of several hundred feet and, though smaller in size, in form is somewhat suggestive of the famous Sugar-loaf Rock at the entrance to the harbor of Rio de Janeiro. This is called Treasure Rock, and no Venezuelan ever passes the spot without casting envious glances at the top. In the days when the old Spaniards were still wandering over the newly discovered lands in search of El Dorado, so the story goes, they penetrated far into the Cerro de Sipapo and found rich treasures in gold and precious stones. The Guajibo Indians, in whose domain they had penetrated and whom they had robbed, finally tired of their unwelcome guests and chased them down the river. In desperation, the Spaniards formed a stronghold on this island rock, driving iron spikes into its sides as a means of reaching the top. For many, many weeks they resisted a siege by the savage hordes, but with the coming of the rainy season the Indians withdrew to their mountain fastness. Finally the Spaniards came down, cutting off the spikes as they descended. They feared pursuit, and so left the treasure on the rock, hoping to come for it when reinforcements had been secured; they never returned, and to this day the fabulous wealth of the Guajibos lies untouched on the top of the impregnable boulder.

The Meta is a mighty river, coming from the immense prairie region of eastern Colombia. It is navigable for the greater part of its course and should be the means of opening up illimitable grazing areas when the Orinoco is thrown open to free navigation. Where the Meta joins the Orinoco the latter is fully two miles wide; near its mouth the country is covered with a dense scrub growth. As we neared the mouth of the great river several large canoes filled with Indians, of the Guajibo tribe, shot from an invisible hiding-place near the bank and made for the center of the stream. They have an unsavory reputation, and Captain Solano added little gaiety to the occasion when he prophesied an attack and armed his men. On they came, swiftly and silently, the dusky, naked bodies bending in perfect unison, and the great muscles of the arms and shoulders glistening in the sunlight as they drove the short, pointed paddles deep into

FIG. 3.

FIG. 4.

FIG. 3—The "port" of Vagre on the middle Orinoco.

FIG. 4—The end of the portage around the Guajibo Rapids on the middle Orinoco. These are the mo dangerous rapids of the whole river.

Fig. 5.

Fig. 6.

Fig. 5—Granite outlier of the Guiana Highlands near Caicara on the Orínoco.
Fig. 6—Tropical rubber collector's camp on the middle Orinoco.

the water with vigorous strokes; but our suspicions proved to be unfound They passed rapidly on some secret mission of their own without even c descending to glance in our direction. This utter indifference to strange I found later, is a characteristic common to all Indians of the up Orinoco. A man might be drowning or stranded on a rock, but they wo pass him quietly in their canoes without apparently seeing him; they wo pay not the slightest attention to his cries for help. Their ill-treatment the hands of strangers has been so great that they have lost all confide in anyone unknown to them; and so they retaliate by feigning indiffere to him, even in his direst need.

The nights were usually spent aboard ship. If there was no wind was safe to tie up to some tree; or if darkness overtook us near a *pla* the anchor was carried ashore and buried in the sand. While the c prepared supper on the brazier, or over a fire built on the bank, hammo were strung in the rigging, and then we fished until time to retire.

Fish were always abundant and of many varieties. One kind that w taken frequently and that was excellent eating was a catfish, weighing to twenty-eight pounds, of a deep brownish color, with wavy bluish gr lines running along its sides, called *vagre tigre*. Another species of c fish, frequently of a weight of seventy-five pounds or more and of a de slate color, was not uncommon. There was also a third kind, about eight inches long, with a large, narrow head and "feelers" as long as t body; it was always sure to be among the catch. But neither of t two last-named was ever eaten, as the flesh was said to be poisono The crew was always careful to clean all fish immediately and pl them under cover; if left exposed to the moonlight over night they w unfit for food.

The hoarse cough of jaguars was heard almost nightly; it was the seas when great numbers of turtles left the river at nightfall to deposit th eggs in the sandbanks, and the jaguars left the forest at dark to dig and feed on these eggs. One night, just as the boat had drawn up to t high, sandy bank preparatory to tying up, one of the huge cats was d covered sitting ten feet above us quietly surveying the scene on deck. The was a rush for the guns, but when they were secured the jaguar had d appeared. A clear sweep of loose sand with a low bush here and th stretched back a mile from the river to the heavy forest, and in the brillia moonlight it was easy to trace the animal's tracks as it started towa cover. Several times its shadowy form was visible, slinking from o bush to another a few rods away, but always out of range; after half hour the tracks were lost in the edge of the forest. We returned to t ship. Before replacing the guns in the hatch, one of the men casual broke his, which action led to the discovery that it contained no shell neither were the others loaded. One of the men while cleaning them th afternoon had removed the cartridges and failed to reload them. Fort

ately the jaguar is not quite as savage as he is usually pictured, or there ight have been a lively scene on the *playa.*

There is but one other rapid of importance in the Orinoco before the ataracts of Atures are reached, and that is San Borja, not far above the outh of the Meta. Just above this narrow stretch of seething water we et another boat about the size of the *Hilo de Oro,* which was cruising back nd forth near the bank, her crew directing loud shouts into the forest at requent intervals. Upon inquiry, we found that one of the crew had gone to the woods to cut a pole; the other members of the crew had heard im chopping, as he had not entered the matted vegetation more than fifty eet; suddenly the chopping ceased, but the man did not come out; although hey had searched far and near no trace of him had been found, and this as the fourth day after his disappearance. The supposition was that e had been killed and carried away by Indians.

Perico was formerly the port of call for sailing craft below Atures. t the time of our arrival there was nothing whatever there, not even a ingle hut. We continued up the river half a mile to a place called Vagre; ere we found the remains of two palm-leaf huts, long since fallen down nd overgrown with vegetation. In the small clearing a few cotton stalks, eans, pawpaws, and castor-bean bushes still struggled for existence with he invading hosts of creepers and second-growth sprouts; the forest was apidly reclaiming its own. On the sandy riverbank were the tracks of aguars and caimans. At this point the river is divided by islands into number of branches, and the one on which Vagre was situated is not over ve hundred feet wide. Beyond this point a boat of any size cannot pro-eed; it is the foot of the series of cataracts, six miles long, known as the apids of Atures. We sent a man overland to Zamuro for a *falca,* which a canoe with the sides heightened with boards; and, while our luggage as being rowed up the swift stream, we walked near the bank.

The aneroid, read at water-level, gave an elevation of two hundred feet; erhaps this is somewhat too low. Between Vagre and Zamuro a row of ounded, black rocks rise to a height of two hundred and fifty feet above he river on the eastern side. Many boulders of enormous proportions lie prinkled about in the most irregular manner, as far as we could see, and spots there are outcroppings of ledges of quartz. The tops of the ounded granite hills are hard and glazed, so that they glisten in the sun-ght as if covered with a coating of ice. There are but a few stunted trees, nd, where any vegetation can get a foothold, tough, wiry grass grows; this the home of many rabbits and rattlesnakes.

Zamuro we found to consist of three grass huts newly built and occu-ied by sick, miserable Venezuelan families. The heat is terrific, and osquitoes and sandflies first begin to make their presence known in con-iderable numbers. The river scenery is really magnificent; huge boulders f fantastic shape strew the river bed and rear their heads high above the

FIG. 7.

FIG. 8.

FIG. 7—Vegetation in a tropical lagoon.

FIG. 8—The town of Atures on the middle Orinoco.

Fig. 9.

Fig. 10.

Fig. 9—The Orinoco above Atures Rapids. Note the savana vegetation.

Fig. 10—Maipures settlement on the middle Orinoco, showing a clump of *serrapia* trees.

seething torrent; against them the water dashes ceaselessly, surging and swirling in a mad endeavor to destroy them, only to be baffled by the immovable sentinels and hurled back again to dash against their brethren, equally unrelenting and equally impervious to the roaring onslaught. The scene is awe-inspiring.

The next step was to secure ox-carts to carry the impedimenta to the Rio Catañapo, three miles away, and this we crossed in a canoe landing practically at Atures. The Governor of the Upper Orinoco, General Roberto Pulido, made Catañapo his home. He was ordinarily supposed to reside in San Fernando de Atabapo, but on account of his arbitrary methods of government he was so greatly disliked that he decided it was "healthier" to live elsewhere.

The Catañapo is a turbulent stream of clear, cold water that dashes down from the nearby Cerro Sipapo. Not far above its mouth is a good-sized village of the Piaroas, who came down occasionally with plantains, *papayas,* and other fruits, which they exchanged for cloth and sugar at Atures. When the Indians come down they apparently bring with them numbers of freshly killed monkeys, whose flesh is greatly esteemed as food. We saw several heaps of the charred bones near frequently used camping sites, here as well as at Zamuro.

The Catañapo abounds in fish; its water is so clear that they may be seen twenty-five feet or more beneath the surface. Some were fully two feet long and resembled giant black bass; they refused to be tempted with meat bait, but rushed greedily for bright-colored objects such as fruit and flowers; they would take half an orange at a gulp.

Atures, consisting of six or eight mud and grass huts, owes its existence to the fact that the Governor lives on the Catañapo and all the residents are his employes. Formerly the town was larger and there were thirty ox-carts plying back and forth across the portage; but the Governor promptly selected the few he wanted and then discouraged competition in such a manner that he was shortly left alone in the field. To us he was most cordial and immediately placed his carts at our disposal. He did not examine our luggage or perform the self-imposed duty of extracting from it anything that suited his fancy.

The two miles from Atures to Salvajito, the port of embarkation above Atures Rapids, were covered in ox-carts which lumbered slowly along over the uneven semi-arid country. Salvajito was only a small cleared space in the forest fringing the river.

The next step of the journey was to traverse the forty miles of river between Atures and the second great cataract at Maipures. Only a small canoe was available; and so, leaving my assistant and a number of the men to guard the left-over luggage, I started with three paddlers. The canoe was only eighteen feet long, with about two inches of freeboard, but fortune favored us, and after two days we reached the mouth of the Tuparo. The

irst night out had been spent on a *laja*, or shelf of rock which extends nto the river; the men set fire to the dry vegetation back of the camp in rder to keep away jaguars and built a fence of brands along the outer dge of the rock to frighten off the crocodiles. The second night was spent n a large sandbank just below the rapid of Guajibo. In approaching this ite the canoe had been caught in a sudden hurricane and swamped before and could be reached; but fortunately we had gained shallow water, so that othing was lost. On this sandbar lived three species of terns, one of very mall size that came in immense flocks after nightfall and, dropping on he sand, immediately disappeared from view; also numbers of yellow-legs nd a few gulls. The wind blew steadily all night, so that by morning verything and everyone was half buried in the loose sand.

The rapid of Guajibo is one of the most treacherous in the whole Orinoco. Each year the rubber-gatherers pay heavy toll in lives while traversing his notorious spot. A great horseshoe-shaped ledge of rock extends across ractically the entire river, and over this the water rushes at great speed; elow is a series of scattered rocks extending for a quarter of a mile, forming a raging, roaring gorge. We portaged around the spot, although the ountry is very difficult, owing to the many high rocks and the deep crevices etween them. An acquaintance who had just passed attempted to have his ien drag their boat through, with the result that they lost the canoe and iree men. Shortly after, a large *piragua* coming from up river attempted) run the rapids to save time; seven of the crew, as well as the owner of ie outfit, paid for their folly with their lives, and the entire cargo of rubber ɔgether with the boat was lost. A few days later, another party wrecked ieir canoe and lost two men. These are all cases which came under our otice, and I was told of many others.

The port of Maipures is on the Rio Tuparo, about half a mile above its iouth. This river, some two hundred yards wide, comes rushing out of ie interior of Colombia down a rocky river bed. When the landing was ffected we found only the parched plain, a trail leading away from the iver to the settlement of Maipures, a good three miles away. We pitched amp near the water, and the canoe and two men were immediately sent ack for another load of our equipment. There was not much life along iis part of the river. Numerous iguanas spent the hot hours burrowing ı the sand, and if disturbed either ran away in the brush or plunged into ie water. Both green and blue kingfishers clattered noisily on the opposite de, and a few large gray herons flapped up and down over the center of ie stream. We could constantly hear the loud roar of the Maipures Rapids, nd the water rushing down the course of the main river was covered with ɔam.

Five days after our arrival the second load, in charge of Mr. Iglseder, rrived. They had met with a mishap in the rapid of Guajibo, and one ıan and the canoe were lost. For nearly two days they had been stranded

on an island and besieged by a party of Indians from the Sipapo; the occupants of a passing canoe, seeing their plight, came to the rescue, and brought them on to the Tuparo. While the borrowed canoe returned for the remaining members of the party, we busied ourselves transferring camp to Maipures, above the head of the rapids. The intervening country is level and covered with a sparse growth of wiry grass and patches of low woods; near the watercourse the trees are taller and the vegetation more dense. The town, consisting of six adobe houses with thatched roofs, nestles in a little grove of mango and tonka-bean trees, and from a short distance away is very picturesque; but, like all the rest of the plain, it is insufferably hot, and the myriads of sandflies quivering like heat waves in the air make life almost unbearable.

While waiting for a boat of ample size to take us up the river to San Fernando de Atabapo, we had time to explore the surrounding country and to visit the rapids, three in number, which obstruct the river. The woods are wonderful beyond description; most of the trees are gnarled and low as if grown under the guiding hand of a skillful Japanese gardener, and have the appearance of being hundreds of years old. Stunted spiny palms rear their crowns here and there, and an occasional tangle of red-flowered creepers forms an umbrella-like mass on the tip of a slender, dead stub. The ground is sprinkled with rocks of fantastic shapes, and some are of enormous size, which rise in needle-like, fluted columns or like crumbling tiers of massive walls amid the curiously distorted vegetation. Along the river are other masses of rock, but of an entirely different formation; there are caves and grottoes, and ledges honeycombed with hundreds of pot-holes exposed by the low water.

Beyond the woods are extensive areas of cacti, pineapples, and low thorny bushes, springing from crevices in the granite ledges. Bird-life is abundant and varied. Quail and red-breasted meadowlarks occupy the open country as well as a species of the much-sought *tinamou;* but a bird that proved to be the most interesting was a small, obscure individual called nunlet or swallow-wing. All day long the little creature, about the size of a king-bird, black above and gray below, with a saffron band across the throat sits on the top of some dead tree, seemingly asleep; but let a fly or insect of almost any kind pass along and the bird immediately becomes charged with activity and darts into the air in hot pursuit, catches its victim and returns to its perch with graceful flits of the wings. It remains on the same twigs for hours, and usually returns day after day. If a stick is thrown at it the little creature flies away and comes back again and again. But, stupid as the bird appears to be, it is nevertheless a skillful architect. I have seen it dig perfectly round holes deep into a bank of sand so loose that the whole mass would crumble at my touch; while one bird digs with much scratching and working of wings, the mate sits on a branch near by and gives a twitter of alarm upon the approach of danger. Some

members of the family build a huge pile of twigs on the entrance to their burrow to hide it; at the end of the tunnel, a foot or two back, the snow-white eggs are laid upon a thin layer of straw and feathers.

The highest falls in the river are known as Carretia and are supposed to be about thirty feet high; they block the eastern channel of the river, here divided into two branches by the immense Isla de Raton. In the western arm the Raudal del Conejo and the Raudal Saltinero effectively block this watercourse to navigation. It is said that the Spaniards built a road from Atures to the foot of the Cerro Sipapo above the falls of Carretia, and that the Indians still follow this route occasionally. If true, this was doubtless a great convenience, as it did away with the necessity of navigating some fifty-odd miles of the most difficult and dangerous waterway of the entire river.

A large boat called *piragua* was obtained, and in this the expedition traveled to San Fernando de Atabapo in six days' time. The river is dotted with a number of islands, the largest being the Isla de Raton, all heavily forested; the current is frequently so strong that no headway could be made either by rowing or poling the heavy boat. At such times a thick cable of the braided fiber of a palm called *chiquechique* had to be requisitioned, and everybody walked on the bank dragging the boat slowly along. The very first day the man in the lead ran into a bush-master fully eight feet long and narrowly escaped the vicious thrust of the deadly reptile. A charge of shot soon put an end to the creature's menacing career, but the men jumped into the boat and did not want us to take along the dead snake, as they said its mate would be sure to follow and inflict a terrible revenge for the loss of its companion. This kind of superstition is very common among the natives on the Orinoco; few of them would dare shoot a jaguar, as they firmly believe that for every one slain a member of their own family would be carried away by one of the huge spotted cats.

The country on the Colombian side, from below Atures onward, is level llano, covered with a good growth of grass, and having an abundance of water. Some day, no doubt, and that in the near future, numerous herds of cattle will graze in the rich pasturage awaiting them, and another source will be added to the world's limited supply of meat.[1] A fringe of trees grows along the river; among them are the valuable *cachicamo* and *cedro*, the trunks of which are frequently fashioned into canoes by the natives.

The Vichada, at this season, had dwindled down until at its mouth it was not more than a hundred yards wide. We could see a range of hills far to the west, dimly outlined against the sky and finally fading into obscurity in the haze; in this direction the river has its origin. Several Piaroa families had settled near the junction of the two rivers and built a large hut of palm leaves and grass. The men lounged in their hammocks

[1] On this topic see "The Cattle Industry of the Llanos," by Walter Lefferts, *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 180-187.—Edit. Note.

all day long, drinking rum and fighting the clouds of sandflies whic feasted on their half-naked bodies; at night they crossed to one of th numerous sandbanks and collected basketfuls of turtle eggs and also a many turtles as their canoes would hold. Some of their canoes were mer shells, so small that we could never learn how to handle them; no matte how quietly we sat they upset as soon as pushed out into the current, bu an Indian or even two would calmly squat down in the bottom, take up thei paddles, and glide away without the least concern.

The women were making cassava bread. After the tubers *(Manihc utilissima)* are ground, and the juice has been extracted, a thin layer of th coarse meal is spread on the bottom of a shallow pan about three feet i diameter; the heat causes the particles to adhere, forming a tough, roun wafer which can be turned without breaking and is thoroughly baked o both sides. When cold it hardens, and the huge slabs are then done up i bundles of twenty to forty each, wrapped in plantain leaves, and in th way kept indefinitely. This is the bread of the Orinoco and is always ca ried as the main article of provision by Indians and travelers alike; whe needed, pieces are broken off, dipped into the river to soak a few minute and then eaten. While not particularly appetizing, the slightly acid flavc is not unpleasant, and if there is time to toast it just before using it is reall quite palatable. Another article commonly prepared by the Piaroas is tl bark of a certain tree, called *tabari*. Long, narrow strips are cut from th trees and alternately soaked in water and beaten between rocks until th thin layers separate into tissue-like sheets; these are used in rollin cigarettes.

One of the granite ledges flanking the river just above the Piaro dwelling bears on its surface a number of curious figures, carved in th face of the rock; unfortunately the water was so low that we passed fa beneath them, and I was unable to make out just what they were; but th canoe-men who had seen them a number of times said they were figures c men and date back to prehistoric times.

The country now rapidly grows wilder; tall forest replaces llanos c scattered growth, and the camps of rubber-collectors dot the river bank One afternoon, as we poled quietly along, we came upon a huge anacond coiled up on a sandbank; all about were iguanas three or four feet lon digging nesting-burrows in the loose sand. The snake had just caught or of the big lizards and was crushing it into a limp mass, but the others pai not the slightest attention to the tragedy which was being enacted in the midst and ran about or worked but a few feet away. When we approache to within twenty feet the anaconda dropped its victim and flung itself int the water; some of the iguanas followed it, and others scampered away ove the sand.

That night we reached the low sandy island of Tanaja and, ascendin one of the branches of the river, made camp on the rocky mainland. Th

water is sluggish and shallow, so that we could easily see the muddy bottom six or eight feet below. As the boat moved slowly along we became aware of masses of black, flitting shadows underneath, and soon made out shoals of fish of various sizes that literally covered the bottom. There were rays, electric eels, catfish, and *piranhas,* by the thousands, besides many others which we could not identify; the reason for their congregating in this shallow place is hard to guess.

The boulders on the bank were dotted with what we at first took to be lichens; but examination showed them to be nighthawks *(Chordeiles rupestris)* of a light gray color, which clung to the rounded top, silent and immovable, as if carved out of stone. When we paddled across to the island a short while after we found scores of others, but these were the females squatting on one or two fragile, speckled eggs which had been laid in shallow hollows scooped out of the warm sand. They were very tame and permitted me to walk up to within a few feet of them; then they took wing and with noiseless, graceful flaps flew a short distance away and dropped back on the sand.

Flocks of red and blue macaws flew screaming across the river in quest of some favorite tree in which to spend the night, far in the depths of the forest; after them trailed parrots of various sizes and colors, always flying two by two. Herons flapped lazily upstream, and snakebirds, perched on snags, looked down at the masses of fish below, apparently regretting their limited capacity for eating. Exciting as this naturally must be to a field naturalist, it was but a foretaste of what we were to find each day farther up the river.

As the morning of January 24 sped by, the water of the Orinoco began to assume a dark color, and by four o'clock that afternoon we had reached the mouth of the Atabapo; an hour and a half later we had ascended the clear, red water of that river for a distance of three miles and tied the *piragua* to the ledge below San Fernando.

San Fernando de Atabapo is the last settlement on the Orinoco, and was the base from which we hoped to make our way to the unexplored regions about Mount Duida. This part of the expedition will be dealt with in a subsequent article.

CONGESTION IN CITIES

By SIDNEY A. REEVE

Congestion in cities is a phenomenon too obvious to need proof. It i one of the most alarming symptoms of recent social evolution that th people are ceasing to inhabit the country. The resultant deficit in the foo supply, on the one hand, and the unwholesome crowding of slums an apartments in the larger cities and factory towns, on the other, are rapidl becoming a real menace to public health and social stability. There ar plenty of statistics published as to this. The question is not: Does congestion exist? It is, instead: What are its causes and its cure?

Growth of American Cities

The national facts as to the growth of cities are these:

Table I—Growth of American Cities
(Communities of 10,000 Inhabitants and Over)

Year	Per Cent of Population Living in Cities	Number of Cities			Average Size of City	Newark, N. J.
		Total Number	Per Cent Increase	Number per Million Inhabitants		
1850	12.2	66	..	2.85	42,900	39,000
1860	15.0	86	30	2.82	54,900	72,000
1870	19.7	151	75	3.91	50,300	105,000
1880	21.5	201	33	4.01	53,600	136,000
1890	28.0	340	20	5.40	51,900	182,000
1900	34.6	394	16	5.16	67,000	246,000
1910	40.1	568	44	6.18	65,000	347,000

The marked acceleration in rate of city growth between 1860 and 1870 i due not to any direct influence of the Civil War but to its indirect result– the period of commercial prosperity extending from 1864 to 1872 inclusive Commercialism is the great compacting force.

The apparent drop in rate from 1880 to 1900 is only partly real. During that period the political boundaries of cities, in their expansion, di not keep up with the actual consolidation of population. What are no known as "metropolitan districts" had already begun to form—group of municipalities, villages, etc., really constituting a single community, bu not such by law. The censuses preceding 1900 took no cognizance of thi process. Those of 1900 and 1910 give the populations both of the origina component political units and of the non-political aggregations, so tha by 1910 the artificial distortion of the apparent rate of growth due to thi

FIG. 1—Pedestrian traffic congestion at the noon hour on lower Broadway, New York City. (Cour. of the Committee on the City Plan, Board of Estimate and Apportionment, City of New York.)

cause had been eliminated. In reality, the average rate of increase for th entire sixty years, 36 per cent per decade, was never far departed fron in any one decade.

The growth of Newark, N. J., is given as a sample, to show how erro neous must be conclusions as to the growth of congestion as a nationa phenomenon, if drawn from the observation of the growth of any one city That is to say, during the last sixty years Newark, New York City, anc almost every other single city have grown to a size eight or nine times tha of 1850. Yet the *average* size of all cities throughout the land has grow by only about half! But this does not mean that Newark and New Yorl are exceptional cities in their growth, to such a degree that there ar enough other cities which have grown so much more slowly that the averag is thereby brought down by this marked contrast. The paradox lies i the fact that nearly every other city has grown about as fast as Newarl and New York have grown.

The explanation of this paradox is to be found in the vast increase i *number* of cities. All the new cities of course enter the average by cross ing the ten-thousand mark from below. The smallest class of cities ha grown in number almost as fast as each city has grown in size. This situ ation may be understood by considering the average age of a family durin the child-bearing period. Suppose that the parents marry at twenty an that thereafter they have a child each two years. Then the average age o the entire family, stated each two years until there are four children, wil be 20, 15, 13, 12.2, and 12 respectively. Yet during this continuous dro in average age each member of the family is growing older by two-yea jumps!

Classification of Cities

This fact has deceived many into imagining that consolidation of popu lation is proceeding faster than it really is. The truth is revealed by classification of cities as to size. The United States Census classificatio recognizes the roughly obvious fact that for any given size of city the num ber of cities in the land varies inversely as that size. Therefore the rang of each class in population should increase as the order of classes proceed upward in size. Thus the smallest class is stated to range from 10,000 t 25,000, the next from 25,000 to 100,000, the next from 100,000 to 250,00 and so on.

But this plan puts a ratio of lower to upper limit of 1:2½ in som classes and 1:4 in others, which is manifestly unfair. These ratios shoul be the same for all classes. This is accomplished (when there is one clas intermediate between each two having a relative ratio of 1:10) by usin the ratio $1 : \sqrt{10} = 1 : 3.162$. In the following tables this principle of classi fication has been followed. The upper limit of each class is 3.162 time the lower limit.

Table II—Distribution of Total Population

Year	Per Cent of Total Population						
	Communities smaller than 10,000	Class A 10,000 to 31,620	Class B 31,620 to 100,000	Class C 100,000 to 316,200	Class D 316,200 to 1,000,000	Class E 1,000,000 to 3,162,000	Class F 3,162,000 to 10,000,000
850.....	87.8	3.3	2.3	2.6	4.0	....	....
860.....	85.0	3.1	2.8	3.4	1.8	3.7	....
870.....	80.3	4.7	3.0	5.4	2.8	3.8	....
880....	78.5	4.7	3.2	5.0	4.5	4.1	....
890.....	72.0	6.6	5.0	4.5	4.2	7.7	....
900.....	65.4	6.2	5.2	5.0	5 9	6.2	6.0
910.	59.9	7.3	6.0	4.4	7.8	7.6	7.0

Table III—Average Size of City

Year	Communities smaller than 10,000	Class A	Class B	Class C	Class D	Class E	Class F
850.....	......	15,830	44,060	147,135	481,000	....	....
860.....	......	15,640	55,500	184,200	580,000	1,169,500	....
870	......	16,000	49,300	189,000	531,000	1,461,000	....
880....	......	16,030	50,000	190,000	565,000	2,026,000	....
890	......	15,470	52,750	190,000	444,300	1,614,000	....
900.....	......	16,800	51,600	174,500	500,100	1,570,000	4,608,000
910.....	.....	16,070	53,400	155,500	513,140	1,745,500	6,475,000
verage		15,980	50,940	175,760	516,400	1,598,000	5,541,000
eometric mean between limits......		17,780	56,200	177,800	562,000	1,778,000	5,620,000
rithmetic mean between limits......		20,810	65,810	208,100	658,100	2,081,000	6,581,000

Table IV—Relative Distribution Between Classes

Year	Theoretical Figure if Population were Distributed Equally	Per cent of the Total for all Classes represented					
		Class A	Class B	Class C	Class D	Class E	Class F
50.....	25	27	19	21	33	...	...
60.....	20	21	19	23	12	25	...
70	20	24	15	27	14	20	...
80.....	20	22	15	23	21	19	...
90	20	24	18	16	15	27	...
00.....	16.7	18	15	15	17	18	17
10.....	16.7	18	15	11	19	19	18

In this system of classification, if the rough rule of inverse proportions ere followed exactly by the actual population in distributing itself among ie various classes, then the total population would be found to be divided jually among the several classes, irrespective of number or size of class. able IV shows that this rule holds true in a manner which, even if only pproximate, is yet striking. It leaves little room for doubt that this verse-proportion rule, which is one of fluid equilibrium in inanimate iture, forms the natural law of equilibrium of distribution of population cities, *when not interfered with by force.*

Parallel evidence in support of this view is found in the lower lines of able III. The close coincidence of the actual average with the geometric,

rather than the arithmetic, mean between the class limits proves that t inverse-proportion rule is fairly true.

But the above evidence in support of the inverse-proportion rule based only upon communities larger than ten thousand persons ea Examination of the distribution of the remainder of the population sho a considerable departure from the rule. The presence of some extrane force perturbing the natural evenness of distribution is beyond questi Thus, comparing the aggregate population in communities less than t thousand with the largest city in the country, New York, it develops t the former is diminishing, and the aggregate population in cities ab ten thousand is increasing, relatively to the inverse-proportion rule. F according to this rule, the aggregate population up to any given size community should vary as the logarithm of the given size. But the actual bears a ratio to this theoretical value which varies as follows:

1850	*1860*	*1870*	*1880*	*1890*	*1900*	*1910*
27	29	36	38	48	57	64

This growth from 27 to 64 indicates an abnormal growth in urban po lation at a rate 2.37 times the "normal."

Or, if one prefers the theory that the average size of city, like t average age of a community, should remain constant, in spite of the co tinuous growth of each individual city, then the actual growth of o cities, as observed from the sixth column of Table I, has been 1.51 tin the "normal" rate.

It is some such figures as these, and not the eight- or nine-fold visi in the growth of almost any single city, which indicate the true rate which the natural distribution of population between small and la communities has been abnormally disturbed toward congestion by so extraneous or unwholesome force.

Cause of Congestion

It is impossible to treat this topic within the limits of a magazi article, yet there is ample room for *stating* the cause. The proof of t statement would demand a treatise. The reader must accept some thi here on faith.

A century or so ago industry was conducted on what is known as t "cottage system," in which each workman worked by himself, used sma simple, cheap tools, and *owned* everything connected with his trade—too raw material, and finished product. He must not only make, but a buy and sell, skillfully, else he got no "wages." But means of transp tation were then most crude, and the population accessible was confin usually to the workman's own village. So he got along, in spite of t handicap which the inefficient plan of doing everything himself entailed.

But invention along two distinct lines of progress has complet changed all this. The first line of invention was *factory tools and pri*

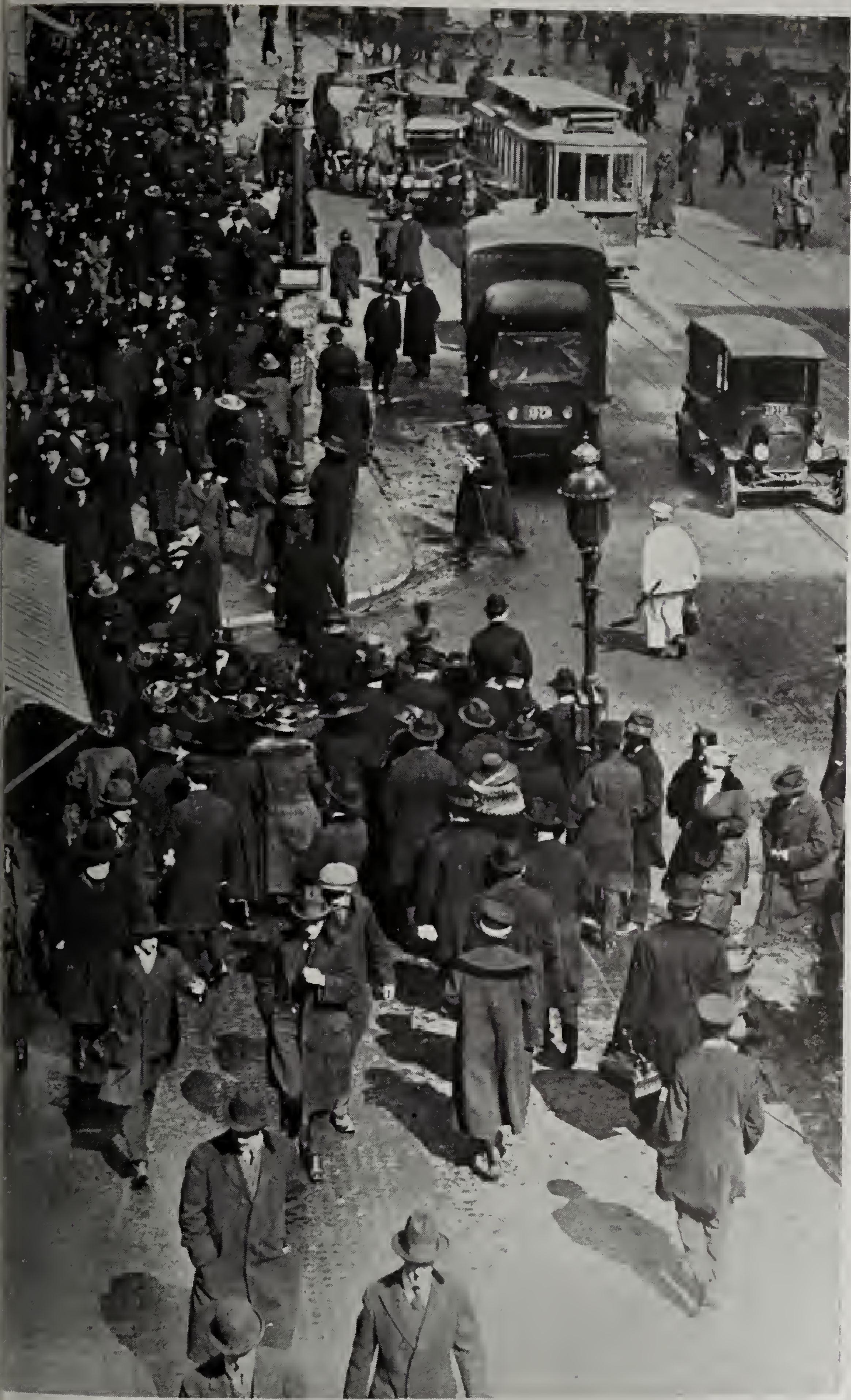


FIG. 2—Pedestrian traffic congestion at the noon hour on lower Broadway at Fulton Street, New York
ty. (Photo taken for this article; copyright, 1917, by Underwood & Underwood, New York.)

movers. This transformed the cottage shop into the huge factories today. It has multiplied the ease and rate of production of material weal beyond human comprehension. In many instances it is not too much say that a given commodity now costs in labor only a fiftieth or a hu dredth of what it did a century ago.

But this progress in efficiency has been accomplished only by the rig exclusion from the factory of all ownership of either tools, raw materi or finished product by the workman; and therefore by eliminating buying and selling. Every factory owner is agreed upon this polic If any reader is inclined to doubt the fact that the wonderful productivi of the modern factory is due primarily to this elimination of intern ownership, rather than to modern tools and motors, let him imagine t most modern of factory plants presenting itself to its superintende some fine morning, as having miraculously experienced "ownership" du ing the preceding night. Imagine his finding that it was now universa accepted law that no tool could be used unless some workman might found able to own it and that no other workman than its owner might u the tool. Imagine the number of modern tools which would be co spicuous by their absence or their idleness under this plan! Imagi what would happen every time a workman chanced to be absent f illness or what not—how all the half-finished work preceding his partic lar process must pile up until its owners could no longer afford to accum late it, because he was not there to buy it off their hands; and how t workmen following this particular one must fall idle because their supp of raw material had ceased. Imagine then the task of negotiating separat the price of each transfer of each bit of half-finished work at each st in its progress through the shop, at prices varying constantly as one another saw opportunity for profit by pushing or holding back exchan Imagine the difficulty of determining by dicker the person to underta the next step in manufacture; for there could be no definite assignme of route of work from man to man. Ownership means license to as one pleases with the thing owned and to trade it wherever the b profit can be found; and freedom to own always means duplication multiplication of people attempting to effect the same supply or dema

Imagine also each boiler room "owned" by some nervy fighter bargains, its furnaces fired by half-hearted second-rate firemen, while ev workman must pay tribute for steam to this owner. And imagine ea engine room privately owned, with several in competition for supply power to the same factory and all power denied except to him who pay tribute—not to reimburse the engine runner for his labor nor to m good depreciation, but to pay the owner a tax for his ownership above these expenses. And imagine each tool room and pattern room and st room similarly owned and operated for the profit of the owner rat than controlled, as now, by a wage-paid non-owner for the good of

ntire factory. And then imagine every one of these features existing ı multiple within each factory, each workman having to journey from ıe to the other, seeking the best possible bargain, for each tool, pattern, g, casting, paint pot, or supply of whatever sort. What would any man affairs say would be the efficiency of such a factory, however modern s equipment, as compared with the modern actuality, which forbids all rivate ownership? Would it be as much as five per cent? It certainly ould not be ten per cent.

For every employer of factory labor has always, without denying the eneral right of private property, forbidden absolutely the bringing of e institution of private ownership into the factory. Ownership and vnership-in-industry are two widely different things. Yet, from the point view of the ultimate consumer, who employs all industry and pays all its various costs, the present plan of having each factory and shipment goods privately and independently owned appears exactly as needless ıd inefficient a way, relatively to the organization of all industry on e plan universally approved by all employers of labor, as would this ıaginary factory permeated with ownership appear to its astonished and sgusted superintendent. And if the consumer-world were at all business-ke it would take it about as long to start to organize industry on the ıtional factory plan as it would this imaginary superintendent to call in e police and sweep the entire anarchy of cross purposes and antagonism to the street.

For the modern factory, it seems necessary to remind all classes of aders, is a locality of the most active *exchange*—much more so than is ıy market; but there is no buying or selling, because no ownership. In ery factory the entire arrangement is designed by the most skillful ıgineers to facilitate this constant and intricate exchange; yet the fiscal de of the process is conducted, quite unconsciously on the part of the orkmen, through a central office force of cheap clerks in an exceedingly mple manner. There is no reason why this same process should not even more effective if adopted on a national scale. And it would con-itute an enormous gain in efficiency.

For invention along the second line, *transportation and communication*, ıs developed the primitive function of exchange-by-ownership (of the ttage system) into what is now known as the modern market system, contradiction to the factory. Transportation and communication have ry much widened the population accessible to a given point of production. ıe consumer of a given article must now be identified among a world pulation of hundreds of millions, as contrasted with the few hundred llow villagers of the pristine cottage workman.

This task is accomplished in the market system by an endless intricacy buying and selling. While some exchange occurs, there is far more ergy devoted to buying and selling than to actual exchange. Aided by

the invention of the steamship, railroad, telegraph, and telephone, thi market system has grown into a vastly complex and hugely profitabl organization—or field of battle, or Donnybrook Fair, rather, where ever man fights as he pleases. The money procurable in this way by a give amount of exertion far exceeds that attainable by production. "The mone is not made in the factory, but in the New York office," said one successfu manufacturer. The same is true of the farm. The money goes to hi who sells farm produce rather than to him who raises it. While apple rot in the orchards because it does not pay to barrel them and cart the to the station, there is plenty of money being made in selling apples i the city. Salesmen, brokers, speculators, and financiers turn up profit at a rate undreamed in industry.

All this frantic buying and selling in order to secure profits—for i has no connection with desire for consumption of the things bought an reduces consumption by adding its fancy and rising costs of selling t the sober, necessary costs of production and transportation—can be lumpe under the blanket term *negotiation,* or, more broadly still, *commercialism* The great and growing occupation of the day, in spite of our marvelou production of commodities, is not production but commercialism. No insti tution, no faith, no practice, no economic function in the world's histor has ever absorbed human energy on such a scale as commercialism is no doing. Feudalism and chivalry, or the medieval religion which built th cathedrals, were but "pikers" in comparison with it, as their castles over looking the Rhine are but card houses to the skyscrapers towering abo Broadway.

Ten years ago the writer published an analysis of the United State census reports from 1850 to 1900 inclusive, which showed that commer cialism has been growing upon us at a continuous, but accelerating, rate fo at least sixty years.[1] He has now all but completed a more careful revisio of this entire task, including the statistics of 1910 and since, done afres from the start. The later analysis broadly confirms and emphasizes th conclusions of the earlier. It proves that there is nothing in moder civilization—not factory production, nor invention, nor education, no art, nor religion, nor philanthropy, nor government, nor even war, no all of these together—which now absorbs so much American energy or i growing so rapidly in energy, prestige, power, and brilliance as i commercialism.

Now commercialism enforces congestion. It is the extraneous forc which is diverting population away from its natural distribution in fre equilibrium. Briefly, it does this through the following influences:

(1) *Taxing production,* by assigning to the seller in the city the mone which should go to the producer in the country—people follow money.

(2) *Negotiation* between seller and seller, demanding propinquity. Me

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[1] The Cost of Competition, McClure, Phillips & Co., New York, 1906.

FIG. 3.

FIG. 4.

FIG. 3—Trucking on South Street along the East River front, New York City.

FIG. 4—Push-cart congestion, Rivington Street near Orchard Street, New York City. (Both photos urtesy of the Committee on the City Plan.)

cannot negotiate over the price of everything that moves unless they ge in touch with one another. Every source of production must have a sellin office in New York City, with branches in the smaller cities, else it canno produce. And commercialism is constantly multiplying the number o such sales which must be negotiated for each article passing from produce to consumer. For instance, a recent writer in this *Review*[2] speaks of lowe Manhattan as being congested by the lateral pressure of the two limitin rivers; but is this true? The skyscraper district shows no sign of pressur against these lateral bounds. Virtually it does not touch the rivers. Th reason for the congestion of skyscrapers is other than topographical. Sky scrapers exist solely in order to bring negotiators into close touch wit one another. This itself enforces lateral constriction. No skyscraper fa from Broadway yields good office-rents. In other cities, where ther are no narrow topographical limits, the skyscraper districts are als narrow; and even if not so much so as in New York it must be remembere that no other city is so intensely commercial in spirit and practice a New York.

(3) *Luxury* crowds into the cities in order to spend, in close propin quity with other birds of the same feather, the unearned, or at least th exaggerated, incomes acquired through commercialism.

(4) *Factories* of a certain sort—those employing largely unskilled labo or those catering to commercialism, luxury, or display, or those selling i a market which fluctuates widely with season or fashion—enter the citie in order to find floating labor which can be readily discharged or r employed.

(5) *Warehouses* handling goods subject to repeated speculative sale ar located in the city in order to be near the negotiators who dicker over thes particular goods; and also in order that the frequent changes of owne ship in their commodities can be easily paralleled by transshipment fro warehouse to warehouse. But frequent as are these unnecessary costl handlings of goods from warehouse to warehouse by truck over cobblestone they are neither so frequent nor so unnecessary nor so costly as are th changes in their ownership within the market system.

(6) *Labor* crowds into the cities either to abandon "labor" by turn ing to commercialism or else, if remaining labor, to get continuity of emplo ment. The chances against unemployment are best where the greates number of employers are accessible.

(7) *Attendance and supply* must follow the others, in order to fee them.

(8) *Rents,* due to the private ownership of sites, enforce congestio by their tendency to rise to the maximum which "the traffic will bear," and far beyond natural rents. But progress in this direction is impossibl except as it stands to give expression or effect to the processes listed above

[2] Ellsworth Huntington: The Water Barriers of New York City, *Geogr. Rev.*, Vol. 2, 1916, pp. 169–183.

FIG. 5—Sidewalks encumbered with fruit cases in a local wholesale fruit district (Attorney Street near Houston Street), New York City. (Courtesy of the Committee on the City Plan.)

Once abolish commercialism, and the natural tastes of the people will sca ter them to the country, and rents will drop automatically.

Thus the forces producing congestion are all basic and irresistible, wh once that commercialism which every employer excludes rigidly from t premises under his control is admitted into the national industrial syste Congestion is not due to whim. Population gravitates whither it can ma the best, the easiest, and the most certain living. The fact that all ov the world, under every form of government or diversity of climate, if on commercialism has penetrated there, people are flocking from the count to the city should prove that it is not a matter of whim. Reliance up persuasion to get the people "back to the land" is exactly as supersti and impotent a policy as is reliance upon religious processions or carryi a rabbit's foot in the left back-pocket as a preventive of epidemics.

Relief by Rapid Transit

The startling fact about congestion is that reliance, for example, up rapid-transit facilities to relieve congestion is just as superstitious reliance upon persuasion. If there were a fixed volume of population the city, of course increased facilities for circulation would relieve crow ing. But there is no limit to city populations except the ability to g about profitably. These great forces of commercialism are packing peop into the cities just as densely as life can exist there. Any extension transit facilities *permits additional congestion.* Instead of relieving it makes it worse! The whole history of rapid transit and congestion co roborates this fact. New York City is housing some five hundred ne inhabitants each night because, on the average, her transit facilities a expanding at a rate to care for this rate of growth in congestion. Th existing subway, with express trains 700 feet long running every tv minutes and locals 500 feet long every three minutes, is the most inten passenger-carrier in the world's history. Yet the existing subway syste is but a bagatelle compared with that now under construction. What w be the degree of congestion as the result of its operation can be on conjectured!

On May 26, 1907, the *New York Herald* published a symposium of vie on this matter by Mr. Theodore P. Shonts, President of the Interborou and other transit companies; Mr. George S. Rice, Chief Engineer of t Rapid Transit Commission; and the writer. In the writer's contributi was included an abstract of the history of New York's rapid-transit pro lem, a history which should be considered in connection with every discu sion of congestion and its remedies. From it the following is quoted:

> During the sixties the pressure for something better [than the street-car] beca more urgent; but . . . it was not until 1869 that the first elevated construction w undertaken. The first effort was limited to a half-mile of experimental track put up Greenwich Street; but its apparent success led to its further growth into a genuine roa

xtending from Battery Place to Thirtieth Street, the embryo of the present Ninth venue line. But the motive power was by cable, from stationary engines, and was iechanically a failure. By 1871 it had been virtually abandoned as a promise of relief.

The state of public opinion existing at this time is shown by the following editorial emarks appearing in the *Railroad Gazette* for February 17, 1872:

"That the city of New York is sorely in need of greater facilities for transporting ts people to and fro is a fact which is painfully impressed upon all . . . . Every erson who discusses the question is fully satisfied that something must be done."

This editorial might have been written just as opportunely in 1892 or 1902 as in 872. It expresses almost exactly the situation in New York city today, although the ransit-facilities now extend almost to millions where thirty-five years ago they comassed thousands. [And, it might be added now, this editorial is just as timely in 1917 s in 1907.]

During 1872 the old elevated property was purchased by a new organization and was quipped with locomotives, constituting the first really successful elevated rapid transit. 'he traffic of this road during the succeeding five years, within which time the line was xtended to Sixty-first Street, increased as follows:

Year	*Passengers*	*Increase (per cent per annum)*
1873	640,000	...
1874	810,000	27
1875	910,000	12
1876	2,020,000	122
1877	3,150,000	56

These figures show how naturally it should come to pass that the situation by 1877 ıad again become badly congested. In May of that year the same editorials say:

"The [elevated] road has now all the traffic it can accommodate, or rather a little nore. Many have to stand in the cars morning and evening, and no more trains can be ut on."

On November 16, 1877, the *Railroad Gazette* remarks:

"Where so recently there was no means of traveling from Wall Street to Central Park faster than horses could travel there seem likely to be in a few months three steam railroads, all within a belt a mile wide. The question then will no longer be how people can get up and down in the city, but how the three railroads can get traffic enough to support them."

Oh, halcyon dream! Within less than seven months from that date the Sixth Avenue line was opened, and this is the result of the first day's "relief" of congestion, as commented on in the same columns:

"Most notable of all, perhaps, was the amount of traffic, the trains appearing to be generally filled at some point of their run, and that not only in the morning and evening, but also in the middle of the day. Indeed, about noon many were standing in the cars."

After a review of the growth of elevated traffic from 5,500,000 passengers per annum in 1878 to 130,000,000 nine years later, in statistics which need not be repeated, the article continues:

Already in 1881 trains were running during rush-hours under a headway of 82 seconds over a single track, and almost all of the additional facilities provided during succeeding years were in the form of longer trains. Referring to this lengthening of the train, in October, 1885, the *Gazette* remarks:

"A large number of passengers who now have to stand up for a considerable distance will then be able to obtain the seat for which they have paid."

Oh, halcyon dream again! For in October, 1887, only two years later, the same sh
feels forced to remark:

"The chronic overcrowding of the elevated railroads of New York has lately cal
forth some indignant protests from the daily press."

That was the situation twenty years ago. That is virtually the situation today, exc
that it has become steadily worse. During these twenty years transit facilities h
increased by several fold—certainly by over ten per cent per annum—although t
population has increased by only . . . about four per cent per annum. During t
twenty years the congestion has decreased not one iota. Instead, it has increased. . .

In the light of history, what is the use of expecting relief from expanded faciliti
. . . .

The universal reliance upon negotiative effort as the only determinator of pri
filling the cities with hordes of negotiators and their aides; upon the conduct of
service for dividends rather than for the sake of the service, and upon private ownersl
in land—it is the public faith that all these are sacred institutions . . . which alo
fastens congestion upon modern civilized existence with the bonds of fate. So long
we continue in this faith we shall suffer increasingly from congestion, and no amou
of transit facilities may aid us.

To this situation Mr. Shonts contributes the view, after an abstract
the statistical history of traffic, that

It would therefore appear that the solution of this problem must lie in the creati
of additional rapid-transit lines of travel.

And Chief Engineer Rice says, still more unequivocally:

The rapid-transit problem in New York can be solved. There is nothing in t
situation to justify the prophecy that New York must always suffer, or long contin
to suffer, inconvenience in its traffic-facilities.

But he adds later a paragraph which the editor of the *Herald* italiciz
in entirety, as follows:

It is one of the paradoxes of our work that as we increase the facilities of tra
portation we add to its volume in a surprising ratio. In a sense we are therefore worki
in a circle. As quickly as it becomes possible to ride about the city at an increas
rate of speed, and with the opening up of new lines of transit, business increases, popu
tion is attracted to the city, and the problem is vastly complicated.

The above quotations show the state of authoritative opinion in 190
but on July 30, 1916, after nine years of additional experience, t
New York Times quotes, as from an official utterance of the Interborou
Rapid Transit Company, with its own headlines, the following:

New York's Crowds Swamp All Transit

Interborough Says No Growth of Facilities Can Keep Pace With City's Demands

No Relief in Third Tracks

Elevated Traffic Back to Maximum Within a Month, While Subway Jam Increases Steadily

No matter how fast rapid-transit lines are built in New York City, the transportati
needs of the population always seem to keep ahead of them. . . .

The point here to the student of congestion lies in the fact that in t
face of steadily increasing congestion not one of the authorities entrust
with the task of relieving it grasps the real problem at all. Reference

ad here not merely to those connected with actual transit problems, but lso to the authorities on political economy and the universities. While ie urgency of the moment is of course to extend facilities as best we may, hy is it not at all times preached and advertised by all these people that icrease in facilities is no remedy? The fact which was obvious in 1876 has ot yet been learned. We are being led by every teacher to pile up more nd more intense degrees of congestion, by building further transit facili-es, until obviously catastrophe must ensue, without one word of warn-ig that it is impending.

What has been said above, while directed primarily to the one phase f the causes of congestion which is most amenable to statistical measure f progress—urban transit—applies also to every other phase of modern ommercialism. It is mechanical invention which crowds our cities and annot lead people away from them so long as commercialism negatives ie natural inducement for them to seek the country. To cabbages we rant the boon of space, air, and sunlight enough for their natural develop-ent, but not to people. It is not merely the very poor who suffer, but the ell-to-do. Every novel invention, in almost any art, facilitates commer-alism and thus enforces greater congestion.

The problem of congestion in cities thus far surpasses merely that of oor light and air in the slums or the peril of tuberculosis spread thereby cross the avenues. It is one of fundamental social stability. If this tuation has become steadily worse during two generations, and if every pplication of engineering science to it only makes it worse, wherein lies ossible hope of gradual remedy? None such is being discussed. None as even been suggested. Even the need for one has not yet penetrated ie brains of the self-appointed leaders of public opinion on social problems.

THE DATE OF OVIEDO'S MAP OF THE MARACAIBO REGION

By RUDOLPH SCHULLER

One of the few known cartographical documents which refer direc to the expeditions in search of El Dorado undertaken during the Wel administration in Venezuela is a small pen sketch-map facsimiled the Madrid edition of Oviedo's "Historia General y Natural de Indias."[1] This map (Fig. 1), doubtless Oviedo's own work, bears indication of date or authorship. It is plainly drawn and legibly wr ten and, in the facsimile, measures 240 by 190 mm.[2] Degrees of longitu and latitude are missing. The map exhibits the section of the northe coast of South America between the Rio Grande (the present Magdale River, Colombia) and Cape San Román (Venezuela), the Laguna Maracaibo, the territories situated between the latter and the Rio Gran and the hinterland to the south of the "Laguna" as far as the river cal Yuma.[3]

The first description of this map was published by Henry Harrisse his "Cartographia Americana Vetustissima,"[4] where it is included am the charts of 1532. The great savant, who was the foremost author of his day on the history of early American cartography, assures us th "this map accompanied a relation sent to Charles V, concerning, app ently, the events which led to the death of the German governor Venezuela," and that "Oviedo added a copy of it to his Historia Gener because, said he [Oviedo], it differs materially from the one made by Alo de Chaves."[5] Yet the chronicler of the Indies states explicitly: " . . . *porque la figura que llevaron pintada, para que la Çessárea Magestad viesse, es muy diferente de la carta, la qual pongo aqui*"[6] (because t figure [map] which they [the procurators] took with them, in order th the Imperial Majesty might see it, is much different from the chart I p here).

Harrisse was mistaken. The map which Luis Gonçalez de Leyva a Alonso de Lallana, the two royal procurators of the province of Venezue

[1] Historia General y Natural de las Indias, Islas y Tierra-Firme del Mar Océano, por el Capitan G zalo Fernandez de Oviedo y Valdés . . . . . edited by José Amador de los Rios, 4 vols., Real Academia d Historia, Madrid, 1851-55. The map is Pl. 3 of Vol. 2, 1852. The narrative is contained in Book XXV (V 2, pp. 269-331).

[2] Harrisse, *op. cit.* in footnote 4, p. 592, gives "240 by 100 mm."

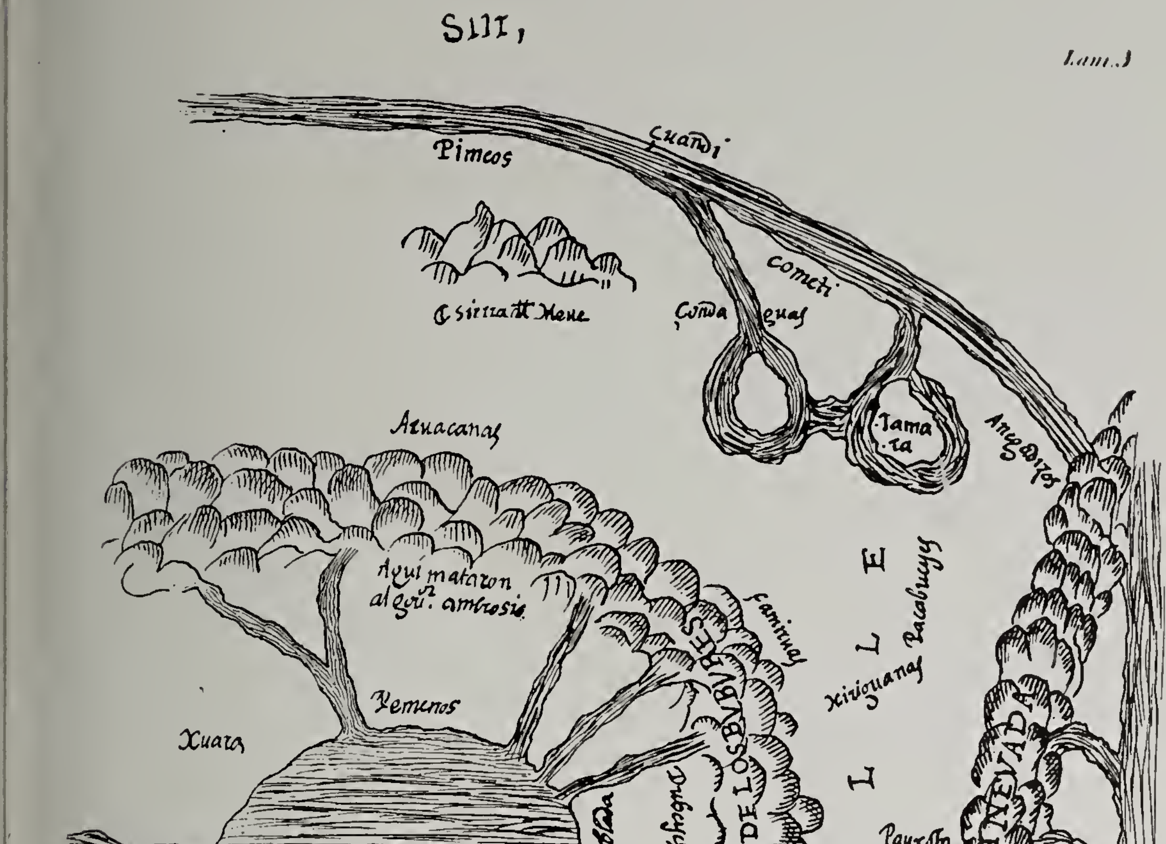
[3] Oviedo, Vol. 2, p. 276a (i. e. first column).

[4] Forming Part Third of his "The Discovery of North America: A Critical, Documentary, and H toric Investigation," London, 1892; reference on p. 592.

[5] Oviedo, Vol. 2, p. 270a.

[6] Harrisse's mutilated transcript of Oviedo's text shows plainly that he misunderstood the Spa original.

'esented to the emperor Charles V was altogether different from the one serted by Oviedo in Book XXV of his "General and Natural History of e Indies." As to the date of 1532 ascribed by him to Oviedo's map of the



Lit. de F. Craus.

FIG. 1—Facsimile of Oviedo's map of the Maracaibo region. (From Pl. 3 of Vol. 2 of Oviedo's "Historia eneral y Natural de las Indias, etc.," edited by José Amador de los Rios. 4 vols., Madrid, 1851-55.) South at the top. A modern representation of the region is shown in the northwestern corner of the map n p. 259 in this number.

Iaracaibo region, we may say that there was no other reason for adopting t than the legend which refers to the fate of the German adventurer

Ambrosio Ehinger,[7] called also Alfinger and sometimes Dalfinger.[8] T legend, at the foot of the mountains to the south of the "Laguna," re as follows: *Aqui mataron / al gou.or ambrosio* (here they killed Gover Ambrosio). And, according to Harrisse, he was killed by the Indi *in the summer of 1532.*

Now let us examine this point. Ambrosio Alfinger arrived at Co February 24, 1528.[9] In the same year he led the first exploring expedit into the territory of the Onoto[10] Indians, a poor and harmless fisher-peo —the "masters of the Laguna"[11]—whose houses were built upon pile They occupied likewise the territories situated to the west of the narro *(El pasaje[13])* of the "Laguna," where Ambrosio Ehinger founded a lit town. This place was named Maracaibo, in honor of the Onoto *caciq* who, with his tribe, first settled down in the very vicinity of the n Spanish colony.[14] Soon afterwards Alfinger returned to Coro.[15]

After having settled the affairs of the colony and made Luis Sarmie acting governor, Ambrosio started again in the summer of 1530[16] to expl the eastern shores and adjoining parts of the "Laguna." During t voyage he discovered the province of Xuara (Ajuduara, or Xuruar which, according to Oviedo's map, was situated to the southeast of t "Laguna." There he embarked, and went to the town of Maracaibo.

In the meantime, his brother Georg, with 123 new Spanish coloni and 24 German miners, had arrived in Coro.[17] Georg Ehinger made attempt to depose Sarmiento and to create himself governor. There w serious troubles, and Georg was finally compelled to leave the settleme He re-embarked and returned to Hispaniola.

Afterwards came Nikolaus Federmann.[18] When he landed at Co Ambrosio had already been about eight months in the interior.[19] And

[7] There were three brothers: Enrique (Heinrich), Jorge (Georg), and Ambrosio (Ambrosius) Ehin In the Spanish documents they are often confounded with Cinquer; cf. "Capitulación que se tomó Enrique Cinquer y Guillermo (Jeronimo?) Sayller, para la pacificación de la Provincia de Santa Mart Madrid, March 27, 1528: in *Colecc. Docs. Inéd.* Vol. 22, Madrid, 1874, pp. 251-256.

[8] Historia de la Conquista y Población de la Provincia de Venezuela, escrita por D. José de Ovied Baños, 2 vols., Madrid, 1885.

[9] Oviedo, Vol. 2, p. 269a.

[10] This name is evidently of Carib origin. Oto, in Carib, means "people"; cf. Purug-oto, Cacipag-o Cumanag-oto, Parag-oto, etc.

[11] "Relación de las tierras y provincias de la gobernación de Venezuela," in Oviedo y Baños, *op.* Vol. 2, p. 229.

[12] See the description of the lake-dwellers encountered by Amérigo Vespucci, in 1499; ". . . . we lan in a port where we found a village built over the water, like Venice. There were about forty-four hou shaped like bells, built upon very large piles, having entrances by means of drawbridges, so that, by l ing the bridges from house to house, the inhabitants could pass through the whole. When the people s us they appeared to be afraid of us, and, to protect themselves, suddenly raised all their bridges and s themselves up in their houses." (Vespucci's letter on his so-called second voyage, in F. A. de Varnhag Amerigo Vespucci, Lima, 1865.)

[13] See the map, Figure 1, and Oviedo, Vol. 2, p. 295a: ". . . . the port, or strait of Maracaybo."

[14] Konrad Haebler: Die überseeischen Unternehmungen der Welser und ihrer Gesellschafter, Leip C. L. Hirschfeld, 1903, p. 166.

[15] The explorations carried out by governor Ehinger in the vicinity of the Laguna de Maracaibo 1529 and 1530 are not mentioned by Oviedo. See on this subject Haebler, *loc. cit.*

[16] *Op. cit.* in footnote 24, pp. 14-16.

[17] January 15, 1530, *ibid.*, p. 14.

[18] March 8, 1530, *ibid.*, p. 15.

[19] *Ibid.*

›ril 18, 1530,[20] there disembarked Hans Seissenhofer, who, being the rep-›entative of Heinrich Ehinger and Hieronymus Sailer, was recognized legal governor during the absence of Ambrosio. The latter, however, retly informed by his friends of all that happened in the colony, urned immediately to Coro, where he appeared fifteen days after Seissen-fer's arrival.[21] On July 30, 1530,[22] Ambrosio left for Santo Domingo, ere he remained until his return to Coro on January 27, 1531.[23]

During this time Federmann, the acting governor, accomplished, hough against the orders he had received from Ambrosio, the expedi-n into the interior, which is described in so boastful a manner in the ndianische Historia."[24]

On Ambrosio's return to Coro the reports made by the Indians as to abundance and richness of gold in a certain "province" situated to south of the regions he had explored in his previous voyages were so tering that he concluded to organize a new expedition in search of t wonderland.

Bartolomé de Santillana had been appointed acting governor. On June 1531, Ambrosio was again under way,[25] in search of the Indians Paca-›es, who, according to the information given by his Indian guides, dwelt the beautiful valley between the "Sierra Nevada" (de Santa Marta) l the "Sierra de los Bubures"[26] (Sierra de Perija). First of all, he it to the town of Maracaibo, to make there all further provisions for difficult and dangerous journey. The next step taken was the recon-tering of a river called by the native Indians Macomite, which flows into "Laguna" about ten leagues north of the aforesaid village.[27] The sel and the two boats sent up this river, however, had to return after r days, on account of the many and perilous shallows in the upper rse.

Meanwhile Lieutenant Luis Gonçalez de Leyva had gone into the ›rior to gather provisions for the colony and the explorers. After his return, Ambrosio started from Maracaibo, September 1, 1531.[28] In country of the Bubures Indians he reviewed his company, having then h him 40 horsemen and 130 *peones*. From thence he entered the moun-is and arrived finally in the province of the Buredes Coronados, Indians ›se language did not differ very markedly from that spoken by the ›ures. The nickname *coronados* refers evidently to the strange kind of

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Ibid.: Haebler, *op. cit.*, p. 172, however, says "April 28, 1530."

Ibid., p. 15.

Ibid., p. 16.

Haebler, *op. cit.*, p. 182.

"Indianische Historia," first printed at Hagenau, 1557; reprinted, with notes, by Dr. Karl Klüpfel ›. 46 in the series *Bibliothek des Litterarischen Vereins in Stuttgart*, Stuttgart, 1859.

Oviedo, Vol. 2, p. 270a.

Ibid. See also the map, Figure 1.

Oviedo, Vol. 2, p. 270b.

Ibid.

hair-cutting noticed among these Indians, which, according to Oviedo,[29] w very similar to that used by the Benedictine monks. The next Indi he met were the Coanaos, settled in the valley between the "Sie Nevada" and "Sierra de los Bubures," about 25 leagues distant fr "Cabo de la Vela." They spoke almost the same idiom as the former, did not practice tonsure.

Proceeding then in a southerly direction, he reached the "provin of the Xiriguanas,[30] a people whose language was entirely different fr the one spoken by the Coanaos. Among the Xiriguana Indians the of tattooing was also observed. His next sojourn was in a village of Indian tribe called Çamiruas, where were found traces of some Span settlers from Santa Marta, who, likewise in search of gold, had pas there several days before. The huts of the Çamiruas were abandon probably due to the excesses committed by the Spaniards. Ambrosio w in need of new guides. The poor Indians who had fled into the for were therefore hunted like game by the heartless intruders. Finally th captured several of them, among whom was a chief who spoke the Xirigua and Pacabuye languages. With this extremely useful guide Ambro went to Mococu,[31] one of the Pacabuye villages, where the adventu stayed over night. Two days afterwards they reached a place cal Pauxoto.[32] In this village Ambrosio awaited Captain Casimir Nuerembe who had been left behind with the carriage.

About four leagues distant from the latter place were the settleme of the Indians called Haraacanas,[33] who used poisoned arrows and w mortal enemies of the Pauxoto. Their village was assaulted, and five six of them were captured. No gold was found there "but evil poison their arrows."[34]

On the next morning Ambrosio arrived again at the village of Paux The rich spoils already amounted to more than thirty thousand *castella* or *pesos*. Ambrosio decided to send Captain Iñigo de Vascuña with thi thousand pesos back to Coro. Vascuña departed with twenty-four pe from Pauxoto on January 6, 1532.[35]

Ambrosio continued the "pacific" conquest of the Pacabuyes. He Pauxoto for Thamara, a great Pacabuye settlement of a thousand *buh* (huts), situated in the marshy vicinity of a lake,[36] about eight leag distant from the former place.

On April 10, 1532, he arrived at Conçepuça, another Indian vill

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[29] Oviedo, Vol. 2, p. 271a. Haebler, *op. cit.*, p. 200, speaks of "feather-crowns," presumably owing misunderstanding of the Spanish text.

[30] Of course, linguistically distinct from the Xiriguano-Tupí (Guarany) of the Bolivian Chaco.

[31] Haebler, *op. cit.*, p. 202, writes "Mocoa."

[32] Undoubtedly the name of a Carib tribe.

[33] Probably a misreading of Arhuacos.

[34] Oviedo, Vol. 2, p. 273a.

[35] *Ibid.*, p. 273b.

[36] Identified by some students with the Laguna de Zapatosa.

ırcely three leagues distant from Thamara. From thence, he went to mpachay, a Çondagua settlement situated on the banks of a great river.[37] is place was abandoned; its inhabitants had fled into the swamps. Yet, the other side of the river, called by the Indians Yuma, there were ıny villages. Ambrosio was anxious to learn more of this interesting ɔple and their country. He sent two of the seized Thamara Indians in ·anoe to visit these villages and to tell the people of his good intentions. e Indian ambassadors succeeded in removing the fear of the natives. ortly afterwards four small boats came with nineteen Indians, who 'ormed Ambrosio that there were several places to the south, a day's ırney distant, where gold abounded in great quantities. Especially : one named Çumiti, it was said, was a greater and richer village than amara. The Indian town called Çuyandio, or Çuandi, situated on the ıer side of the river Yuma, was likewise said to be another place with bounded treasure.

Ambrosio, however, convinced that by proceeding with so small a comıy he would rush himself and his men into certain perdition, concluded return. After a two days' journey they reached the Çondagua settlent of Çonçilloa, from which they departed on the following morning. ntinuing, after two days they arrived again at Mococu (Mocoa; ımoa[38]) and after another day's journey at Iaxaran, an Indian village) leagues distant from Pauxoto.

More than three months had already elapsed since the departure of ptain Vascuña, whose return, of course, was anxiously awaited. Fear; some misfortune might have befallen him and his companions on their ırney, Ambrosio decided to send Estéban Martin, an experienced man ll acquainted with the Indian languages, with twenty peons to Coro that he might learn of Vascuña's fate and return as soon as possible h the much-needed reinforcements.

Having completed the preparations for the perilous trip, Ambrosio saw téban Martin march from Iaxaran on June 24. 1532.[39]

Ambrosio had arrived at Iaxaran on April 20, 1532; he stayed there il September 9 of the same year.[40] The periodical inundations forcibly ained him. In the early autumn he continued his explorations in the ıdagua country. On September 17 following, he entered Zomico,[41] a at and rich village situated in the vicinity of a lake. The natives were ɛndly and hospitable, generous with their provisions, and possessed some d, which they gladly exchanged for European trifles. Ambrosio departed nce on October 5, 1532. The next Çondagua villages he visited were ;ome and Çilano, situated likewise on the border of the lake. Ambrosio

[37] The Magdalena, according to Haebler.
[38] Perhaps a misreading of the editor.
[39] Oviedo, Vol. 2, p. 276b.
[40] *Ibid.*, p. 277a.
[41] "Zornico," in Haebler, *op. cit.*, p. 207, is surely a misreading; cf. Oviedo, Vol. 2, p. 277a.

was informed again of the unbounded richness of gold to be found on other side of the river Yuma. Yet he was already short of men; how co their reduced numbers withstand should they be suddenly attacked by Indians? He dared not run the risk and so returned to Zomico.

In the meantime Estéban Martin, after a thirty-four days' journ across pathless and impenetrable virgin forests, had safely arrived Maracaibo. He came in the nick of time. The Onoto Indians had ri against the Spanish settlers and lately killed fourteen of them. Af having sent some of his men to Coro, in order to bring reinforcemen Estéban Martin went to put down the rebellion. The struggle last several days. Many of the Indians were killed and the rest dispersed captured. The Spaniards had some killed and wounded; among the lat was Estéban Martin, who received five arrow-wounds.

Finally, after thirty-two days of anxious waiting, the reinforceme came. Estéban Martin was confined to his bed on account of his woun Nevertheless, this faithful man was immediately disposed to lead the rel force into the interior. With eighty-two men he left Maracaibo, and af several weeks he joined Ambrosio in the above-mentioned Çondagua villa about a hundred and fifty leagues distant from Coro.[42]

Shortly afterwards Ambrosio resumed his journey. The goal was Çumeti El Dorado, supposed to be encountered on the other side of Yuma. An attempt to cross this river, however, failed. Ambrosio, sor disappointed in his hopes, concluded to return to Coro.[43]

Continuing his voyage in a southerly direction, he reached the provi of the Pimcos Indians, where he remained several days. On the right ba of the upper Yuma there dwelt Indians likewise called Xiriguanas,[44] "they were different" from those Ambrosio had previously met in valley of the Pacabuyes.[45] On leaving the Xiriguanas he changed direction of his route and went into "certain mountains," not very hi although extremely cragged.

Of course it is a difficult task to ascertain, even approximately, wh Ambrosio crossed over that "sierra." All that has been said on this su ject by the chroniclers and the modern historians is mere speculati According to Oviedo, whose account of Ambrosio's exploring expedition undoubtedly based on the official relation which the aforementioned ro procurators presented to the emperor Charles V, Ehinger with his co panions ascended the "Sierra del Mene."[46] At length they reached thickly settled hamlet named "El Mene," in a "certain valley." T Indians fled. Rushing into the deserted dwellings, the invaders found so corn hidden in holes. Skirmishes with the Indians, whose name w Corbagos, were unavoidable. The Spaniards pursued the fleeing Indi to the summit of the "cordillera." After ten days of unsuccessful scouti they returned to Ambrosio's camp. They were short of provisions. T

[42] Oviedo, Vol. 2, p. 278a. [43] *Ibid.*, p. 279a. [44] *Ibid.*, p. 279b. [45] *Ibid.*, p. 272a. [46] *Ibid.*, p. 2

rn was wholly consumed and they were compelled to kill some of their ›gs. Harassed by hunger and by the elements, they continued their urney in those rough and inhospitable mountains. Eight of Ambrosio's mpanions and a hundred and twenty of the Indian servants died in the *iramos,* the bleak, cold uplands in the mountains. Among the victims as also Captain Casimir Nueremberg.[47]

Nothing could be more disheartening than the aspect of these rough ıd unpassable sierras inhabited by wild and warlike Indian tribes, who sented the intrusion of the strangers and tenaciously disputed every pass ith the exhausted Spaniards. They were desperate. At last, the deciated squad arrived in the valley of the Aruacanas. The Indians, on eing the Spaniards, however, burned their huts and fled into the woods. fter a sojourn of several days at the "burned" village, Ambrosio pursued s journey. Finally he reached a valley, which is identified by the hisrians with the Valley of Chinacota.[48] There he met his fate. In a ruggle with the Indians he was seriously wounded from a poisoned arrow hich penetrated his throat. Four days afterwards he died.[49]

The news of Governor Ambrosio's death, which *must have occurred in e beginning of the year 1533, was not known at Coro until November 2 the same year.*[50] Now, inasmuch as the legend referring to Ambrosio's ath is the latest geographical and historical datum in Oviedo's map of e Maracaibo region, the extreme *terminus a quo* for that chart would the last quarter of 1533, or the beginning of 1534.[51] Yet there are wellunded reasons to believe that Oviedo's map might have been made several ars after that date, as the chronicler compares it with the "modern art" (*Padrón General,* i.e. model chart) of the cosmographer Alonso de haves, saying[52] "that [the description of the coast of Venezuela] is so cording to the modern chart of the cosmographer Alonso de Chaves."

We know that the *Padrón General* was first ordered by the emperor harles V in October, 1526, and remained unfinished, so that on May 20, 535, Queen Isabella of Portugal, the emperor's wife, ordered Fernando olumbus to cause the royal cosmographers to proceed with the work.[53] nd Oviedo states expressly: *"La carta moderna del cosmógrapho Alonso e Chaves, que nuevamente se corrigió y emendó el año que passó de mill é uinientos y treynta y seys años."*[54] (The modern map of the cosmog-

[47] A former companion of Sebastian Cabot in his voyage to the river "Solis," afterwards called "Rio la Plata."

[48] Haebler, *op. cit.*, p. 210.

[49] Oviedo, Vol. 2, p. 284b. Haebler is evidently mistaken when he says (*op. cit.*, p. 182) "Ambrosius ist in Maracaibo am 17. November 1532 vorgelegt worden." (It [the ratification of the Royal *cédula*, dated bruary 17, 1531] was presented to Ambrosius in Maracaibo, November 17, 1532.) At that time Ambrosius ıs, as already said, struggling with the Indians of the "Sierra del Mene."

[50] Oviedo, Vol. 2, p. 296a.

[51] Oviedo, Vol. 2, p. 295a: "Mas porque de la gente que volvió por tierra se supo más particularmente los pueblos por donde passaron . . . ." is a further proof of the correctness of this statement.

[52] Oviedo, Vol. 2, p. 270a.

[53] Harrisse, *op. cit.*, pp. 264-268 and 631-633.

[54] Oviedo, Vol. 2, p. 149b.

rapher Alonso de Chaves, which was newly corrected and improved l year, one thousand five hundred and thirty-six.) Then again he sa "*Esto todo segund la carta moderna, fecha por el cosmógrapho Alonso Chaves, el año de mill é quinientos y treynta y seys años, después que po Emperador, nuestro señor, fueron mandados ver y examinar é corregir padrones y cartas de navegar por personas dotas y experimentadas, para ello fueron elegidas.*"[55] (All this according to the modern chart m by the cosmographer Alonso de Chaves, in the year 1536, after the Empe our lord had ordered that the model charts *(padrones)* and sailing cha should be seen and examined by learned and experienced persons appoin to that effect.)

It has been thought necessary to relate all these incidents of Ambros Ehinger's eventful exploring expedition in search of El Dorado, as it the only way in which to obtain an accurate basis for determining the d of Oviedo's map of the Maracaibo region. As has been seen, this can be 1532, as supposed by Harrisse. The earliest possible date is the end 1533 or the beginning of 1534, with the probability that the map was drawn until after 1536.

[55] Oviedo, Vol. 2, p. 150b-151a.

THE GEOGRAPHICAL WORK OF DR. M. A. VEEDER*

By ELLSWORTH HUNTINGTON

THE RELATION BETWEEN SOLAR AND TERRESTRIAL METEOROLOGY

By M. A. VEEDER

Part II—The Electro-Solar Hypothesis

[The preceding part of this article sets forth a large body of facts as o solar changes, cyclonic storms, and other terrestrial phenomena. These eem to suggest that changes in the solar atmosphere are closely fol- owed by changes in that of the earth. They also give ground for the elief that magnetic disturbances, auroras, thunderstorms, and ordinary yclonic storms are closely connected and perhaps owe their origin to a ingle non-terrestrial source. On the basis of these conclusions Dr. Veeder as framed the interesting hypothesis presented in the following paper. n bringing this hypothesis to the attention of students the present writer oes not necessarily accept all its conclusions, for along many lines it has ever been thoroughly investigated. In that very fact, however, lies much f its value. Some such consistent, well-developed hypothesis is needed to timulate investigation. Hence, even if Dr. Veeder has gone farther than he physicists are yet willing to support him, and has attributed to elec- rical action certain phenomena which may be due to other causes, the ollowing pages deserve careful study.

The article which follows was written in 1892. The original manuscript egins with a long introduction dealing with the relation of electricity to ther forms of energy. It then considers the various forces which modify limate: (1) gravitation; (2) heat; (3) the earth's rotation; and (4) lectro-magnetic forces. Since the latter seem to Veeder to have received oo little attention in meteorology, he discusses the various forms under hich electrical action takes place upon the earth and the ways in which ts effects are modified. This leads him from auroras and terrestrial agnetism to meteorology. From this point on, his manuscript is pub- ished in full.—E. H.]

From a meteorological point of view there is a source of variation in lectrical tension and magnetic range that is perhaps more important than ny yet suggested. It is to be found in the varying conductivity of the tmosphere under different conditions of humidity and barometric pressure. he anticyclone, or area of high barometer, appears to act as a reservoir r species of storage battery for magnetic or electrical forces, whilst the elief of tension is accomplished in the region of low barometer immediately

* Concluded from the March *Review*, pp. 188-211.

adjacent. Both conditions of barometric pressure are departures from the normal, but inasmuch as the winds as well as the electrical currents pass from the area of high to that of low the latter may fairly be regarded as subsidiary.

As is plainly shown by the government weather charts, an anticyclone is produced by a downward movement from the upper atmosphere of cold dense, and very dry air, which, when it reaches the earth, flows outward from the place of descent in every direction but with the greatest force toward the point whither the anticyclone is at the time advancing. The central region from which the outflow proceeds is characterized by calms and very high barometer. The clearness of the air at the center promotes heat radiation, thus lowering the temperature and perpetuating the characteristic conditions there existing, causing in certain instances white frosts and, in others, droughts. In its course along the surface of the earth the very cold air is gradually warmed, and, meeting an outflow in an opposite direction from adjacent anticyclones, the currents thus opposed are deflected upward, and a zone of clouds encircling the anticyclone and preventing heat radiation is formed. Latent heat also is liberated, and, in consequence of increasing rarefaction thus produced, the barometer falls forming a trough of low pressure towards which the inflow of air-currents from opposite directions is strengthened, until, at some point where the conditions are most favorable, a fully developed and energetic storm center appears. The rotation of the earth on its axis deflects the air-currents thus put in motion, causing them to move spirally inward toward the center of the cyclone, the centrifugal force generated deepening the barometric depression. Along the margins of an anticyclone several cyclones may be developed, the anticyclone with its encircling cloud belt and attendant cyclones moving together as one complete system.

The cold, dry air of the anticyclone, being a non-conductor of electricity separates the positive electricity of the upper atmosphere from the negative of the earth's surface, thus increasing electrical tension. The restoration of equilibrium can take place only along the margin of the anticyclone through the moist and warm air of the barometric depressions. Thus in the anticyclonic area there is stability of electrical tension and in the cyclonic or storm area great instability of tension. The resulting condition along the margin of the anticyclone in summer is the thunderstorm and in winter the blizzard. Tornadoes occur when, for any reason, either solar or terrestrial, the tension is very great at some one point. If the restoration of equilibrium is through masses of moist air of sufficient extent to afford adequate facility for conduction, there will be diminished intensity of action, whilst the concentration of the same volume of electrical force within narrow limits will cause it to act with disruptive violence.

The increase of electrical tension during the prevalence of anticyclone when the air is cold and clear is made manifest by so simple an experimen

as stroking a cat's fur. Fogs such as those in London prevail only in anticyclones, and during their continuance the tension remains very high.

The methods of cloud formation, the changes of temperature and of barometric pressure and of the direction of the wind, the indications of the electrometer, and the phenomena of thunder and lightning during ordinary storms show that the relief of tension is accomplished along the margin of the anticyclone. Thunderstorms do not burst forth at a single center or vortex but in a long narrow belt. The terrific electrical storm in this vicinity (Lyons, N. Y.) in August, 1885, during a single hour took the form of a belt reaching from northern New York southwestward into Ohio a distance of at least five hundred miles. During a single day a line of thunderstorms has extended with scarcely a break from Newfoundland southwestward to northern Texas, the anticyclonic areas bordering the trough in which these outbursts occurred being situated toward the northwest and southeast of the line indicated. In such cases the more northerly anticyclone advances with the greater energy and has the more clearly defined margin, as is shown by the abruptness of the changes in temperature and in the height of the barometer that mark its progress.

The better defined the margin of the anticyclone, the greater the tendency to concentrate electrical action along a definite line. When for this reason tension is increased, tornadoes are apt to occur, although they are most frequent when the electrical forces are strengthened by increased solar activity.

A funnel-shaped cloud resembling in every particular an incipient tornado has been seen to project itself with a loud roaring sound from a cloud bank such as skirts an advancing anticyclone, but before reaching the earth a lightning flash was emitted from its apex, whereupon it vanished temporarily. As the cloud reappeared again and again the lightning flash was repeated each time, thus relieving the electrical tension and causing the tornado cloud to vanish as before.

Objects seared and burnt as by fire are not infrequently found in the track of tornadoes. The central part of the tornado column presents a luminous appearance also and moves as though controlled by electricity. The steep temperature gradient always present in localities where tornadoes are occurring indicates that a rapid movement of the anticyclone as well as electrical force is concerned in their production.

In sections of the anticyclonic areas characterized by cirrus clouds and solar or lunar halos due to minute ice crystals and a peculiar condition of refrigeration in the upper atmosphere, auroras are most brilliant, and the arrangement of clouds known as polar bands, supposed to be due to magnetic influence, is most frequent. During snow squalls attending the advance of an anticyclone objects exposed to the wind have been seen to become clothed with phosphorescent light which disappeared as soon as they were sheltered from the blast. When an anticyclone ceases to move

rapidly and lingers for days in one place, the swing of the magnetic needl and the range of the height of the barometer may exhibit daily maxim and minima similar to those occurring in the tropics. Thus it become apparent in many ways that a peculiar condition of electrical tensio characterizes the anticyclone.

As a rule at no time is the swing of the magnetic needle more pro nounced than when anticyclones with their attendant cyclones are in rapi motion. And yet we have been assured as the result of a long series o observations that the agitation of the needle observable at such times i almost positive proof of the existence of an aurora at some higher latitud if not at the point of observation.

When anticyclones are in rapid motion they usually increase in siz Their development and subsequent movements bear such a close relatio to various electrical and magnetic conditions as at least to suggest th possibility that they may be to some extent under the control of forces o this character.

From this point of view the study of the various characteristics of anti cyclones and especially their manner of movement is of the highest interest Like all other masses of air, they are to an important extent, although no entirely, under the control of the general atmospheric circulation as mad manifest by the course of the trade winds and the anti-trades.

In tropical latitudes the circulation of the winds is such that a belt o anticyclones is formed on each side of the equator, constituting the regio of calms and baffling winds known to sailors as the horse latitudes. I these belts the trade winds take their origin and, blowing toward th equator, form there a barometric trough and zone of clouds similar t that between anticyclones in other localities but in this case encircling th entire earth. As in the case of auroras the distance from the equator o these belts of anticyclones varies with the intensity of solar action. Durin sun-spot maximum anticyclonic conditions increase in Siberia and durin sun-spot minimum they increase in India, causing the droughts which pre vail at such times in that country.

In this connection the remarkable fact may be noted that the sun-spot form two belts, one on each side of the solar equator, and are produce by downward movements in the sun's atmosphere so that they are tru anticyclones, the faculae in their vicinity corresponding to the cloud rin surrounding terrestrial anticyclones and being due to upward current Moreover their distance from the equator is greater at times of increase solar activity, as is the case with terrestrial anticyclones. If the circulatio of the sun's atmosphere is thus similar to that of the earth's it may becom necessary, when this shall have been demonstrated, to revise the theorie commonly accepted in regard to the agency which heat from an externa source has in determining the main features of the atmospheric circulatio It is evident that there is no greater sun near at hand to shine upon th

central luminary of our planetary system and by heating up his equatorial regions to produce a system of trade winds and anti-trades and anti-cyclones as described.

Markings upon the planets Jupiter and Saturn suggest that the circulation of the atmosphere in their case also may be similar to that which appears to exist upon the sun and earth.

In the region of the prevailing westerly winds the anticyclone tends to drift in the direction determined by the winds, but not always. Elevated plateaus or a dry continental climate may perpetuate anticyclones or cause them to linger persistently at certain seasons of the year. Thus in Siberia there is a permanent winter anticyclone with barometric pressure often above thirty-one inches.

Not only do anticyclones exhibit a tendency to linger in certain localities or drift with the usual atmospheric currents; they at times appear to possess a force of their own sufficient to break up the regular course of the atmospheric circulation over an extended portion of the earth's surface. In this case they move more or less directly from the polar toward the equatorial regions. At times movements of this character are so sudden and of such extent that they can scarcely be due to variations in solar heat.

In summer and over great bodies of water at all seasons the colder air currents confine themselves for the most part to the upper atmosphere. At the hottest season of the year, about August 1, during an ordinary storm a temperature cold enough to freeze mercury has been encountered during a balloon ascension at the height of a few thousand feet above the city of Paris. Thus both in summer and winter a wave of cold air has been traced southward from Saskatchewan in British America to Venezuela, South America, its progress in each case being attended by auroral and magnetic phenomena and severe storms. Upon such an occasion, on December 16, 1857, a brilliant aurora appeared in southern California, where auroras of any kind are almost unknown.

When an anticyclone pursues the course just described, sweeping over an entire continent and extending so near the equator that in elevated situations far within the tropics the cold air current is felt, the movement is as a rule one of a series of like character which may encircle a large section of the earth's surface. Thus a group of cold waves has swept far southward at the same time over Europe and America and extensive portions of the Atlantic and Pacific Oceans. As these masses of cold air drift eastward with the prevailing westerly winds the impression produced upon an observer who looks only at the phenomena occurring in his immediate vicinity may be such as to lead him to suppose that there has been a succession of impulses producing storms instead of a succession of storms due to a single impulse. This phenomenon is most apparent in winter for reasons that will become plain when the theory of these movements has been fully explained.

Only anticyclones that are of recent formation or comparatively fre from the polar regions appear to be capable of energetic movements. Wh once they begin to linger, the storms that attend their subsequent care are less violent. Indeed when very extensive and motionless they preve storms, which cannot occur until they are broken up or set in motion l some fresh impulse.

The sudden and surge-like movements of anticyclones and the sharpne of their margins when advancing rapidly are inconsistent with the theo that they are put in motion by rarefaction of the atmosphere due to he in the equatorial regions and vicinity. An indraft of cold air due to su rarefaction, which is constantly in progress, ought to proceed graduall regularly, and continuously, which is not the case.

Condensation of aqueous vapor along the border of the advancing ant cyclone may modify the phenomena there in progress but cannot be t sole or chief cause of the movements of the anticyclone for the very pla reason that they occur without it. On October 14, 1886, a very energet anticyclone and cyclone swept over the eastern part of the United Stat but were attended by scarcely any cloudiness or rain. High winds as rule are not attended by rain. On the other hand during a northeast stor it has rained daily for a week but the condensation of moisture and co sequent liberation of latent heat failed to put in motion the anticyclo along whose margin it occurred, the barometer persistently remaining hig Nor is it the rotary movement of the cyclone that puts in motion t anticyclone. A northwest storm covering half the United States and lasti for several days cannot be due to a cyclonic movement of the winds tra able over an area not larger than two or three states. Such an explanati is not more reasonable than it would be to ascribe the flow of the water a stream to the swirls and eddies that form in the midst of the current.

A tendency to the establishment of a twenty-six day period of co waves or anticyclones both in summer and in winter for months togeth has been fully as apparent as any similar periodicity of auroras. T proof that the aurora is of solar origin, however, rests for the most pa upon exceptional outbursts rather than regular recurrences. So far as t writer has been able to learn, as the result of considerable research, adequate attempt has ever been made to determine precisely the sol conditions on which the appearance of the aurora depends. Thus far n a word has been found in any treatise or article that would enable a observer looking at the sun to form any decided opinion as to whether a disturbances there visible might or might not originate an aurora. Th being the case, inability to specify the exact solar conditions that may cau anticyclonic movements cannot be regarded as a fatal objection to t theory that they are in part at least of solar origin.

Nor has any adequate attempt ever been made to determine the exa reason why the aurora so frequently remains a mere local phenomenon.

; only in rare instances during solar outbreaks of great energy that the urora encircles the entire earth and becomes visible in the lower latitudes. ikewise magnetic storms coincident with auroras are rarely of equal intenity in localities far apart. Whatever may be the character of the impulse rom the sun, whether magnetic, thermal, electrical, or ethereal, it may xhaust itself or assume some other form of manifestation after having iven rise to an aurora and magnetic storm confined for the most part to ery narrow limits. The anticyclone may be dissipated or fail of developient in certain localities, and this likewise is true of auroras. Both alike re modified by local influences and in spite of the most intense solar ctivity may fail to appear at certain times or places. If the solar origin f auroras and magnetic storms is not doubted, because they remain for ie most part merely local, it is hardly fair to assume that anticyclonic iovements cannot be of solar origin because for the most part they, too, emain comparatively local.

As in the case of auroras proof should be sought at times of heightened olar activity as determined both by telescopic and magnetic observations. s the result of an attempt to isolate and properly estimate the influence f a single solar disturbance the fact has been noted that, when the sun unusually calm, if a disturbance comes into view by rotation, the earth's tmosphere is as a rule at once thrown into commotion and cold waves soon ecome prevalent.

In view of these various considerations it becomes apparent that the ianner of progression of the anticyclone as well as the phenomena occuring along its margin may to an important extent be the result of the lectrical and perhaps magnetic properties with which it has been endowed, resumably by solar influence.

Since the time of Faraday it has been known that air belongs to the lass of paramagnetic substances, which, when free to move, are characterzed by arranging themselves in a direction parallel to lines of magnetic orce. It is now conceded that the earth possesses the properties of a iagnet. Consequently if there be any tendency on the part of the atmoshere to be put in motion by electrical or magnetic forces the direction of ich movement will tend to be along the magnetic meridians or approxiiately north and south.

As a matter of fact such movements of colder and warmer masses of air orthward and southward do occur simultaneously at all seasons of the ear and in such relations to solar disturbances and at times with such eriodicity and very often with such auroral, magnetic, and electrical henomena that it is probable that they may be due to special solar npulses of the character indicated throughout this discussion. Thus the ariability of the weather and exceptional outbursts of storm energy may e explained.

It now becomes possible also to explain the differences between storms

in winter and summer. The dryness of the air in winter maintains elect cal tension so that at that season storms are not suddenly dissipated as summer nor are they accompanied by thunder and lightning as a ru The condensation of aqueous vapor, which occurs more freely in summ instead of putting storms in motion and causing them to traverse a wi area, checks their progress by suddenly exhausting the electrical forc upon which their movement depends. If rarefaction of the atmosphe through heat were the chief agency that puts storms in motion they ought travel further in summer than in winter, which is not the case.

In short, it is the activity of movement of storms that depends upon t strength and persistence as well as the method of relief of tension of t magnetic and electrical forces imparted directly or indirectly by sol influence. The atmosphere is simply thrown into a state of commotion the special solar impulse, whilst the subsequent changes of temperature a of the direction of the winds, the rainfall and the deepening of barometr depressions, and other phenomena depend upon the laws governing t movements and relations of anticyclones and cyclones which have alrea been discussed in detail. The investigations of the electrical properti of the atmosphere carried on under the direction of the Signal Servi Bureau are of great interest and importance from the point of view he indicated.

The possible relation of earthquakes to anticyclones and their attenda phenomena is likewise worthy of special study. Electrical or magnet forces, originated, stored up, and made effective in the ways that have be suggested, may affect not only the atmosphere but also superficial stra of the earth's crust which for any reason are in a state of unstal equilibrium.

Doubtless slight earth tremors as well as the more moderate atmosphe movements are in progress continuously, constituting the normal state affairs under ordinary solar and terrestrial conditions. At irregular inte vals or in periods approximating twenty-six days there may be for reaso made apparent throughout this discussion increased tension and sever and more extensive storms and earthquakes. The fluctuations of eart quake activity are strikingly similar to those manifest in connection wi the appearance of the aurora and movements of anticyclones, atmospher and solar as well as subterreanean conditions being concerned in dete mining the time and place of the occurrence of shocks.

These points are well illustrated by the series of periods of increas earthquake activity that have been in progress since last August [1891? From August 27 to September 1 shocks were numerous throughout t earth. In Greece and in South Carolina and upon one of the Friend Islands in the Pacific Ocean there was great loss of life and property, whil milder shocks were phenomenally widespread. At this time several sol disturbances located upon a section of the sun that for months previous

ad been actively disturbed came into view by rotation. Coincidently the ving of the magnetic needle was much increased, and an anticyclone or old wave pushed rapidly southward both in this country and Europe. The hanges of temperature in London, England, were so sudden and extreme hat they were made the subject of a special cable dispatch. In the United tates the anticyclone was of unusual persistence and extent. During the rst week in September there were numerous frosts in the western states nd deep snow in Oregon. Earthquake tremors continued also, in the outhern states, in California, Oregon, and New Mexico, in the south of urope and Sierra Leone, Africa, and upon the Friendly Islands.

Twenty-six days later the solar disturbances which had been very active uring the period just mentioned were more quiescent, their location being istinguishable by the presence of faculae only, no dark spots appearing ntil September 29. Nevertheless there was the same coincidence of shocks n this country and Europe and the same rapid movement southward of xtensive anticyclones. On September 26 and 27 shocks were felt in myrna, Asia Minor, throughout the province of Thuringia, Germany, and n many localities in South Carolina, North Carolina, and Georgia. On eptember 28 the shocks at Charleston were so severe as to cause people o run out of their houses, and on that day also there were alarming shocks n Central America. The extent of the anticyclones which then appeared s shown by the fact that there were severe frosts in Germany and snow n Bavaria, whilst in the United States there were killing frosts in numerous ocalities, a severe norther in Texas and Louisiana, and in the province of Ontario, Canada, there was very heavy snow.

At the next-return of this same region upon the sun it was the seat of everal disturbances which were evidently quite active. On October 22 the everest shocks since August 31 were felt at Charleston and Summerville, nd slight shocks were reported from numerous localities throughout the outhern states and in the Ohio valley. On that day also there were shocks t Athens, Xerochid, Volo, and other localities in Greece. The rise of the arometer occasioned by the anticyclones that then appeared in the United States and Europe on October 25 reached the height of 30.74 in Dakota, whilst in England the *minimum* reported was 30.20, and at Stornoway in he Hebrides the unusual height for that locality of 30.47 was registered.

At the time of the next return of this same area upon the sun it was he seat of groups of faculae only. From November 10 onward for more han a week anticyclonic weather covered almost the entire United States. During this period only slight shocks occurred in various localities in South Carolina, but in Europe on the 12th there were alarming shocks in the Province of Beira, Portugal, and on the following day a tidal wave upposed to be of earthquake origin submerged cities in the south of France, and on the 16th the bark *Bankfields* experienced a shock in lat. 0°50′ N., long. 29°54′ W. Upon the continent of Europe anticyclonic con-

ditions were very persistent, causing the storms that then occurred England to pursue an unusual course, moving almost directly northwa and southward. Throughout this period the disturbances were most atmospheric, culminating on the 16th and 17th in terrific storms on t Great Lakes in this country and a typhoon in the China seas.

From December 6 to 11 earthquakes, storms, and cold waves were aga numerous, the sun at the time being the seat of groups of faculae onl On December 7 there were sharp shocks in Missouri, on the 8th in Charl ton, and on the 11th very severe shocks on the island of Chios and Smyrna. On December 8 the lowest barometric reading, with one exce tion, ever recorded at sea level occurred in England, it being 27.33. (the same day an aurora was seen at Stornoway in the Hebrides, and a co wave was advancing southward in that vicinity.

The period from January 3 to January 9 was of precisely simil character to those which have been described. On the 3rd there we shocks in Maryland, on the 4th there were severe shocks at Charleston a lighter ones at many points in the South Atlantic states. On the 5 shocks occurred in Texas. On the 7th earthquakes in Africa caused t loss of several lives, and in Florida likewise there were shocks on that da On the 9th shocks again occurred in South Carolina and Virginia. Duri this period in the United States and southward there was a cold wave great extent and severity, causing frosts in Mexico. In Europe also t cold was severe, and there were heavy snowstorms in Italy.

At the next return there were earthquakes in Nebraska, on January 2 near the margin of a very large anticyclone which was advancing at t time from the Pacific coast. On February 1 this anticyclone had ov spread almost the entire United States with pressures ranging from 30. to 30.70. In Europe also at the same time there was an enormous an cyclone with maximum pressure above 30.60.

At the next return this section of the sun was the seat of numerous ve active disturbances. On February 17 there were sharp shocks in Missou On the 18th heavy thunderstorms occurred in numerous localities. A Hartford, Connecticut, there was a curious combination of thunderstor and earthquake. On February 22 there was a remarkable outburst up the sun, and the clouds suddenly began to move northward and southwa in a double layer. Great disasters from earthquake occurred in Euro along the margin of an anticyclone. This earthquake recorded itself up the magnetic apparatus at Kew Observatory. On Friday, February 2 an enormous anticyclone covered Europe. In the United States two ant cyclones were located over the eastern and western sections of the countr with an energetic storm between them, and there was a sharp revival earthquake activity in South Carolina.

It would be interesting to trace out other series of shocks and likewi to study in detail the conditions existing at the time of the more remarkab

ıtbreaks, but enough has been said to establish the presumption at least ıat we are dealing with something more than mere coincidences.

Each increase of earthquake activity has been coincident with decided ıagnetic perturbations, although as a rule the aurora has not been widely en in this latitude. In the intervals between the periods that have been escribed there have been shocks forming a series of periods of less extent ıt precisely similar in other respects. These two series comprise nearly l the phenomena of this character since August.

It is evident, however, that increased intensity of shocks at irregular ıtervals as well as in the twenty-six day period may confirm the hypothesis ere presented if it shall be found that the solar and terrestrial conditions oincident with them are of the character that has been described.

Earthquakes as well as auroras are not coincident with every solar disırbance. Perhaps certain outbreaks upon the sun influence the positive ectricity of the upper atmosphere and others the negative electricity of ıe earth's surface.

Variations in the course pursued by the electrical currents in the process restoring the disturbed equilibrium may likewise occasion differences. Then the restoration is by way of the atmosphere severe storms and illiant auroras occur. But when the anticyclonic areas are so situated ıat the restoration is accomplished by way of certain geological strata ırthquakes result.

It is only exceptionally that the conditions are favorable for the occurınce of all the phenomena that have been enumerated in a single locality. sually they are widely distributed, an aurora in one place, an earthquake another, a tornado or thunderstorm in another, a disturbance of the legraph in another, all being coincident with one another and being simply fferent manifestations of the same force modified by local influences.

The conditions existing from November 2 to November 6 [1891?] illusate this point. On November 2 a bright aurora of brief duration was en at Lyons, N. Y., and auroras were visible at many points throughout e northern part of the United States on this day and on November 3 ıd 4. On November 3 a remarkable auroral cloud of great brilliancy was sible at Hamar in Norway, and on November 4 a magnificent aurora vering almost the entire visible heavens appeared in Norway. The sun as free from dark spots at the time, but areas of bright faculae came into ew by rotation, and there was strong magnetic disturbance, as shown by e swaying of the needle. The fluctuations of barometric pressure due the movement of anticyclonic areas were rapid and extreme, as also were e changes of temperature. In spite of the lateness of the season thunderorms of great severity burst forth along the North Atlantic coast, that Bangor, Maine, on the 5th being the severest ever experienced in that cality. On the same day earthquake shocks were numerous in the South tlantic states. In Scotland buildings were unroofed by fierce wind gusts

and tornadoes, in the Lake District in England there was the most remar able storm ever known in that locality, in Germany the weather w characterized by unusual severity, and in the western part of the Unit States there were blizzards, all on November 5th.

In certain localities both the atmospheric and the subterranean con tions are favorable to the production of earthquakes. The chief earthqua regions of the globe are located in the vicinity of the anticyclonic belts each side of the equator, where electrical tension is at a maximum, whi in the region of permanently low barometer near the poles auroras ta the place alike of earthquakes and thunderstorms.

Humidity of the atmosphere in the neighborhood of seacoasts may det mine the course to be taken by the currents passing between the upper a lower surfaces of anticyclonic masses of air, thus increasing the numb of earthquakes locally. Mountain ranges and the conductivity of particul geological strata may have a similar effect.

In New Mexico the air is very dry and electrical tension is larg increased, the working of the telegraph lines is extremely irregular a earthquakes are numerous, their location in this instance being determin by the increase of tension rather than the manner of its relief.

There are other proofs, besides those derived from special instrumen that variations in electrical and magnetic conditions accompany ear quakes. In the *Medical News* for December 11 Dr. Parcher, physician the City Hospital at Charleston, narrates numerous instances in whi sensations precisely similar to shocks from an electrical battery w experienced at the time of earthquakes. Two hours preceding a sev shock in Japan an ordinary horseshoe magnet, which certainly cannot suspected of nervousness or fright, suddenly lost its strength and let f a number of bits of iron that had been attached to it. In numer instances earth currents of electricity affecting the telegraph instrume either strengthening or weakening their action, have preceded earthqual On the island of Martinique in September, 1875, there were repeated ear quake shocks, each preceded by marked disturbance of the telegraph need there in use. Such earth currents accompanying earthquakes in Amer have recorded themselves in Europe. Not only is there an eleven-y period of earthquakes corresponding to those of auroras and magn perturbations, but also the coincidence of individual auroras and ear quakes has been noted in numerous instances. At times the auro phenomena have been localized in a peculiar way in regions where ea quakes were in progress. During the great earthquakes in New Engl in 1727 and 1755 there were flashes of light in the sky. In Sicily *ignes fa* and appearances resembling St. Elmo's fire have been seen during ea quakes.

It may be objected that what has been learned in the laboratory regard to magnetic and electrical forces does not warrant the belief t

ey are capable of producing even ordinary earthquake shocks. Perhaps ot if it be assumed that they are the only agencies concerned. But accordg to the view here presented electrical forces are not required to produce ocks by their unaided strength, although the force manifested by the underbolt indicates that they are not entirely incompetent in this regard. ire, water, chemical action, and perhaps other agencies in the interior of e earth prepare the way, the electrical impulse being the determining use of the shock at the particular time at which it happens.

Whilst it is not denied that there may be earthquakes due to other uses than those of an electrical character the attempt is here made simply outline an hypothesis which shall be consistent with numerous facts and ing into harmonious relations with one another the whole range of obsertions that have been made in regard to magnetic storms, auroras, the ovements of anticyclones, and the fluctuations of earthquake activity.

It has already been shown by the statistical method that there is an even-year period of sun-spots and of auroras and of magnetic and elecical storms, and of East Indian cyclones and of earthquakes and various eteorological phenomena. It now remains to trace out the various relans indicated in detail in some such way as that suggested in this paper.

In attempting to verify practically the hypothesis here outlined it is portant that a comprehensive view of the subject be entertained habituy. Telescopic observations of the sun should be supplemented by infortion in regard to auroras and magnetic and electrical phenomena and ewise by the study of the history attending previous returns of any given sturbed area upon the sun. It not unfrequently happens that a solar sturbance that is telescopically not very impressive is nevertheless decidly active as shown by the auroral, magnetic, and other phenomena that tend its successive returns by solar rotation. On the other hand sunots of considerable size may fail to exert any very marked influence on e magnetic needle or otherwise. In general the brightness and extent the faculae accompanying any solar disturbance afford the most reliable ans of judging at a glance as to its activity. The faculae, however, are ry apt to be overlooked except when near the sun's margin, where they e more easily seen. Moreover they are not unfrequently so evanescent that practically continuous record of the condition of the sun would be quired in order to take into account outbreaks of this character. The termination of the character of solar eruptions by means of the spectrope and the recording of magnetic observations at some point in the inity of the magnetic pole, where phenomena of this kind are much aggerated, are further refinements of method that may be required in ler to complete our knowledge of the subject.

Until methods of observation have been perfected it will be proper to iore the case of storms even of considerable severity that occur when sun appears calm so far as can be determined by the means now in use.

It will be sufficient at the outset to test these theories, as has been done i the case of auroras, by considering the case of solar outbreaks that a manifestly severe and extensive. It is easier also to obtain informati in regard to unusual weather throughout the earth—so that it becon almost inevitable that the details in regard to remarkable outbreaks up the sun and remarkable storms on the earth should receive more attenti than is given to conditions of comparative calm, which are not, howev less important. It will be easier also to study these phenomena when o side of the sun is much more actively disturbed than the other, the twen six day period becoming much more plainly discernible at such times.[2]

According to the view here taken increased tension does not origin storms indifferently everywhere upon the earth's surface but at poi whose location is precisely determined by the meteorological conditions t have been described in the discussion of the character and relations of t anticyclone. A space as large at least as that covered by the United Sta weather maps, comprehending the surroundings of at least one or m anticyclones, should be made the basis of these studies. Information fr this source and from Europe and from the North Atlantic now to be h readily is sufficient to test the hypothesis here presented quite thorough although it is desirable to have as complete a knowledge as possible of t conditions existing throughout the earth at the time of remarkable o breaks. The study in detail of a few well-marked instances will be fou more instructive than the investigation of a multitude in which the c ditions are vague and ill-defined and the information obtainable necessar scanty and incomplete.

Inasmuch as these studies have only become possible as the result f improved facilities recently devised, and as yet are in their infancy, much should not be expected from them at the outset. At times when so disturbances are unusually persistent, remaining active for months togeth it may become possible to forecast periods of severe storms twenty-six d in advance and by means of the daily weather reports it may be possi to determine their probable location a day or two in advance, but the sour of error are so many that it is better to rest content with the humbler t of collecting information that may one day show beyond any possible do that there is a very close and intimate relation between solar and terrestr meteorology.

[2] The fact that the solar period of rotation is spoken of as both 26 and 27 days should not lead to fusion. The average period, as determined from sun-spots, as well as from auroras and magnetic dist ances, is 27¼ days. At different latitudes, however, the sun's apparent period of rotation varies accor to the following table: latitude 0°: 24.5 days; 30°: 26.4 days; 60°: 29.6 days; 80°: 30.6 days. Apparently arises from the presence of a wind system like that of the earth, so that in low latitudes east winds m toward the west and thus diminish the apparent time of rotation, while in higher latitudes west w carry spots and faculae eastward and thus increase the apparent time of rotation. When spots and fac are few in number they generally occur in low latitudes and thus seem to have a short periodicity. W they are numerous they often occur in higher latitudes above 30° and thus require a longer period their return.—E. H.

THE ANDES OF SOUTHERN PERU
A Review*

By THEODORE ROOSEVELT

This is a really notable book; one of those uncommon books in which a an who has had the vision to undertake adventure and the hardihood to rry it through sets forth with wisdom what he has seen. Such combina- on is rare: for it includes the power to do daring and arduous field work, e knowledge that comes from intensive laboratory investigations, the ility to write vividly and simply, and above all the capacity to extract uth from fact, or in other words to give the full meaning, the full philoso- ıy of what would else remain a jumble of unrelated observations.

The book is based on the geographic work of the Yale Peruvian Expedi- on of 1911 which, under the direction of Professor Hiram Bingham, complished so much of capital importance in so many different directions. rofessor Bingham is one of the men to whom science owes much, and his untry even more—for he teaches, not merely by precept but by example, e vital truth that if republics are to prosper the citizens who stand fore- ost in productive scholarship must also stand foremost in readiness to nder personal and bodily service to the commonwealth. The book itself scribes the result of the geographic reconnaissance of the Peruvian Andes ong the seventy-third meridian which was made under the direct lead of r. Isaiah Bowman. Mr. Bowman expresses regret that the exigencies of ıe actual survey, the actual map-making, under exceptionally difficult ıd often hazardous conditions, made it necessary at times to sacrifice me of the geographic work. But so much was done, there is such a wealth important record of observations and of profound deduction from the oservations, that no lack is noticeable. The book is of high value from the ientific standpoint—and possesses the additional merit, not always found scientific books, of being exceedingly interesting even to the layman.

It reflects credit upon the author, upon the director of the expedition, pon the university which sent out the expedition, and upon the American eographical Society, which published in such admirable form an admirable ork. The paper, the letter-press, the abundant photographs and maps, rm a worthy setting. All who are in any way connected with the pro- uction of the book, from those who went on the expedition to those who nanced it, are entitled to ample recognition. Americans of wealth have

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* The Andes of Southern Peru: Geographical Reconnaissance along the Seventy-third Meridian, by aiah Bowman, xi and 336 pp.; maps (including seven topographic sheets, 1:125,000), diagrs., ills., index. ıblished for the American Geographical Society of New York by Henry Holt and Company [New ork], 1916.

done much for this country when they have brought hither art treasu and archeological material from the Old World; but they have done mu more when they have given our own men of the type of Mr. Bingham, M Bowman, and their associates the opportunity to do first-class, origin productive work.

Mr. Bowman has divided his book into two parts; the second pa treats of the physiography of the Peruvian Andes. It is of capital impo tance; but necessarily it appeals primarily to experts and specialists and to be admired rather than enjoyed and understood by that multitude which the present reviewer is one. The first part, however, deals with t "human geography" of the region, and as regards this the appeal, althou perhaps strongest to trained scientific observers, is almost equally stro to all men of intelligence who are interested in the most far-reaching a fundamental of the problems that affect mankind through the ages.

The region considered is one of extraordinary physical contrast. Th of the chapters deal with the dense tropical forests lying eastward of t Andean foothills. In them Mr. Bowman tells of his dangerous boat voya through the canyon of the Urubamba, of the rubber forests, and the for Indians. There are touches of especial interest to the faunal naturalist, when he speaks of the broad trails, leading down through the forest to t river, which are made by the great constrictor. Down these trails the hu serpents glide after nightfall, with lethal stealth, to prey on the red de and the tiger cat as they drink at the water's edge. Another chapter tre of the desert coastal region. All these chapters, treating of the regi lying just east, and just west, of the Andean mountain mass, are importa They show the author's keen insight into actual conditions, human a physical, his understanding of the present in its relation to the past, h grasp of detail, and his power of generalization.

Yet on the whole the most striking chapters are those dealing with t high interior. Two of these, that on "The Country of the Shepherd and that on "The Geographic Basis of Human Character," are not mere of absorbing interest but are of permanent value from the standpoint the man who generalizes with broad wisdom upon a patiently accumulat mass of important data.

These chapters deal with a part of the region which was the seat of t extraordinary Inca culture. There were in the New World two gre centers of civilization-development: north-tropical America, from Hondur to the city of Mexico—the seat of the Maya-Aztec cultures—and the Ande plateau of south-tropical America. These two civilizations, or groups civilizations, were autochthonous, and were mainly independent of ea other. The belief that they were in any substantial degree due to outsi influence from the Old World is conclusively negatived by the fact th they rested on a developed food-cultivation of a kind wholly different fro anything in the Old World. There are worthy persons who believe th

vanderers from among the ancient Egyptians or the Phocnicians, or the Iittites—or the Lord knows whom—brought to America these civilizations eady-made. The "proofs" advanced on behalf of this theory are on a ar with the similar "proofs" advanced by other worthy persons on behalf f the recent existence of Plato's Atlantis, or of the verbal accuracy of the Iosaic accounts of the deluge and tower of Babel, or of a late Tertiary and-bridge between Africa and South America, or of the descent of the North American Indians from the Ten Lost Tribes. With our present nowledge, serious students must regard the American civilizations as aving developed in this hemisphere as the result of an immensely long ntecedent development of which the vital feature was the domestication f various indigenous plants.

As long as tribes subsist on game, fish, and wild fruits, roots, or nuts, heir livelihood remains so precarious that they cannot rise above the level f savages. Under normal conditions, any culture which can be regarded s even on the lowest level of civilization must rest on an assured and herefore artificial food supply, which means a system of plant cultivation; nd this system must develop slowly through a preliminary period of housands of years before the point is reached when out of it blossoms nything which we can call civilized. Unless there is also some taming of nimals the progress is, of course, very much cramped. In America the ood plants which were domesticated differed completely from those lomesticated in the Old World and were of such a character that after he time of Columbus they became almost as important in the eastern emisphere as the Old World food plants became in the western hemisphere.

In North America no quadrupeds were tamed, although the bison was ertainly as susceptible of domestication as any of the Old World species f cattle—ox, zebra, buffalo, yak, gayal—which actually were domesti-ated, and although white goat and peccary could probably have been lomesticated as easily as the sheep, goat, and hog. The Peruvians, how-ver, domesticated the llama, an animal more important in the progress f a primitive race than the sheep, because it could be used as a beast of urden, thus setting free various surplus energies among its owners.

The two centers of advanced culture-development in America were rimarily based, the northern on a long period of preliminary cultivation f maize, beans, and squashes, the southern on a similar period during which the potato and the llama were domesticated and useful varieties lowly produced. There were, of course, many other plants cultivated; and ertain birds, notably the turkey, and possibly one or two rodents, for food. As above pointed out, these civilizations—perhaps it would be more accurate o say pre-civilizations—seem to have grown up entirely independently of he somewhat similar pre-civilizations which struggled up out of savagery n Egypt and in southwestern Asia long before history dawned. The analo-gies—some of which are very curious—seem to be mainly due to what in

biology is called parallel or convergent evolution. Apparently the Amer can civilizations do not date back much before the Christian era, at whic time the corresponding culture-phases of the peoples who dwelt betwee the Nile and the Euphrates had been dead for several thousand year By turning to the February number of *Art and Archæology,* one can se an amusing instance of the similarity between the early artistic effort of utterly disconnected artists, by comparing the earliest known piece o Sumerian engraving—therein given—with the Aztec and Maya figures fou or five thousand years later, with which we are so familiar.

During the immense space of time—perhaps ten or twelve thousan years—which preceded the blossoming period of Inca civilization the peopl themselves, and their plants and animals, were slowly differentiating int fixed types. The llama and alpaca, and the many different kinds of potatoe and of other plants (such as one species of domesticated milkweed), mus have taken thousands of years to develop in their present form; while th Indian himself became rigidly set in character and physique. The whol growth was conditioned by its extraordinary environment; for this civilization grew up on the immensely high Andean plateau, amid surrounding wholly different from all else in the entire world.

Mr. Bowman sketches in masterly outline the inter-relationship of th geography and the human life of this strange region; an inter-relationshi now profoundly modified by the contact between the ancient Indian population and the intrusive Spaniards. On this plateau the pasture lands ar above the forest. Men do not go up the mountain sides to the woods bu down them to the woods. The stretches of farming country lie below th grazing lands and above the matted tree growth of the torrid slopes beneat High above the pastures tower the peaks of everlasting snow. Nowher else has a civilization clung to the bleak uplands and scorned the fertil valleys lower down.

The Indians have been cursed by a pacifist past, and they have suffere the degradation that always in the long run overtakes pacifists in the mass They now suffer from oppression by the whites and mixed-bloods becaus they do not stand up for their rights; and Mr. Bowman speaks of th pleasure it gave him when he did come on isolated groups who were self-respecting and fearless. As with all uncivilized and most civilized people liquor is a peculiar bane. From the fertile farming lands the capital owning, enterprising whites tend to oust them, only the exceptional Indians being able to stand the competition. The same thing is true of the cities at low levels. In the higher cities, where the thin air, the harsh climate and the lack of comfort and opportunity forbid the presence of prosperous enterprising, better-class whites, the Indians show at their worst, being debauched by the few whites whose necessities drive them to these out-of-the-way places—for high altitude and isolation always mean demoralization of character among the Andean whites.

Above these cities, on the lofty pasture lands, the Indian shepherds, ith their flocks of llamas and sheep, lead a much healthier life. Here they e beyond the reach of white competition, for to the white man the con- itions of life are literally intolerable, whereas the Indian has been fitted them physically and mentally, by his ancestral history for ten thousand ears and over. As Mr. Bowman puts it, the Indian of the lofty plateaus id the white man respond to entirely different stimuli. The luxuries id comforts of the whites mean nothing to the Indian. He is content ith his own simple implements, rude clothing, rough fare, and squalid ielter. His solitary life of rambling with his flocks makes him satisfied ith the barren social life and isolation of the little mountain hamlet where lives when at home. He is content with his harsh and narrow existence id regards the complex life of the whites with incurious aloofness. He ves substantially as his ancestors lived a thousand years ago; as Mr. Bow- ian happily puts it, the new elements that have come into his life have ome only by a process of ethnic seepage.

Mr. Bowman excels in using concrete examples to show the inter- lationship of geography and human culture. He shows how the ancient ty of Cuzco originally owed its prominence to its geographic position, hich rendered it dominant over a large tributary region; and how in its irn this dominance became self-stimulating and grew out of all propor- on to its original differences, which were due to nature. He shows how iarply defined climatic and vegetal contrasts between two sides of a great iountain chain produce and condition the accompanying anthropo- eographic contrasts. He points out how much more closely topography related to the life of the people in the Andean region than, for instance, i our own Rocky Mountain region; how there is a vertical stratification f the people which corresponds with the superimposed strata of the land nd the climate.

In dealing with the causes of man's complicated distribution over the arth—the most interesting and important problem before the modern eographer—Mr. Bowman acutely points out that very often the same esults flow from diametrically opposite causes; that, for instance, migra- ion in mass may be due to a succession of very wet or a succession of very ry seasons; that, again, both exceptional security and exceptional isecurity may alike tend towards the wide distribution of men over a given rea. Especially wise is Mr. Bowman's refusal to follow those of his ellow-geographers who, dazzled by the discovery of the profound effect f geographical conditions upon human nature, promptly proceed to explain ll the immense complexus of the forces of social causation as simply due geographical causes; who, for example, explain the Mohammedan con- uests by dry seasons in Arabia, just as the political economists of similar ype explain the crusader by a glutted European labor market—neither f these particular explanations having more than the very slightest foun-

dation in fact. Mr. Bowman rightly insists upon the immense importan of economic, and therefore of geographic, causes in the development human character; but he insists no less emphatically that non-econom forces, what may be called spiritual forces—ranging from fetishistic whir to the loftiest emotions of the human soul—are at times epoch-making their strength and effects. Geography has a profound effect upon cha acter, but character is never a product of geography alone.

The temptation is great to discuss at length the many points of dee interest raised by Mr. Bowman—his illuminating study of revolutionai conditions in Peru, for instance; but to do this adequately would need volume the size of his own. He has written a book of extraordinary intere and importance, based on first-class original field work, on a wide know edge of the written work of others, and on trained ability and power interpreting and drawing far-reaching conclusions from both that whic he has seen and that of which he has read.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Meetings of March. The regular monthly meeting of the American Geographical ociety was held on March 20 at the Engineering Societies' Building, 29 West Thirty-inth Street. President Greenough presided. In addition to presenting the David ivingstone Centenary Medal to Colonel Theodore Roosevelt on behalf of the Society, s described at the beginning of this number, the President submitted for confirmation he names of 130 candidates for Fellowship. Thereupon a vote was taken and they were eclared elected.

On March 6, at an inter-monthly meeting, Professor J. Russell Smith, of the Uni-ersity of Pennsylvania, addressed the Society on "The Mediterranean Tree Farmers." 'he lecture described the practice, common in Mediterranean countries, of planting fruit nd other productive trees in regions unfit for agriculture. Professor Smith's extensive eld studies in North Africa, Spain, and Portugal have led him to believe that the same ethod could be applied with profit in our Appalachian region and semi-arid West. An rticle by him dealing with one phase of this topic will be remembered by readers of he *Review* ("The Oak Tree and Man's Environment" in the January, 1916, number).

The Annals of the Association of American Geographers. Volume 6, for 1916, of he *Annals of the Association of American Geographers* has just appeared. In accord-nce with the reciprocal arrangement between the Association and this Society, a copy f the Annals may be obtained free of charge by Fellows of the American Geographical ociety who make a written request for it. It consists of technical papers which are ainly of interest to professional geographers. The present volume contains: "Some 'roblems in Geographic Education, With Special Reference to Secondary Schools," by . E. Dodge; "Physiographic Divisions of the United States," with map, 1:7,000,000, y N. E. Fenneman; "The Prevailing Winds of the United States," by R. DeC. Ward; 'Memorial of Edward Van Dyke Robinson," by R. E. Dodge. Extended notices will ppear later in the *Review.*

NORTH AMERICA

Revival of the American Merchant Marine. Discussion of the present low status f our merchant marine inevitably evokes a comparison with conditions in the golden ge of American shipbuilding sixty years ago. It is recalled that the tonnage of nearly 00,000 built in 1855 has only once been exceeded since, in 1908, the high figure for that ear being accounted for by the great output of steel vessels to accommodate the extraor-inary commercial development of the Great Lakes. After the impetus to navigation iven by the California gold discoveries American ocean navigation fell rapidly behind, n part through the failure of the American yards to turn to the new steam-driven essels that were fast superseding the old sailing ships.

The present heavy demand for ocean-going ships has called forth a revival in all ranches of the shipbuilding industry. Returns to the Bureau of Navigation of the)epartment of Commerce on January 1, 1917, show under construction or contract ves-els with a tonnage of over 1,700,000, exclusive of those for the navy. This is nearly s much as the total world tonnage put out in 1916. About 12 per cent of it represents 'ooden ships. The small wooden sailing ships are reaping unwonted harvests today. 'rom local coasting trade they have turned to overseas trade; several, for instance, are ngaged in carrying coal and lumber to South American ports. The United States is ot the only gainer in this respect. A recent *Commerce Report* (Nov. 20, 1916) notes hat a large fleet of small Danish schooners, diverted from the Baltic, is engaged in a arrying trade between Chatham, New Brunswick, and Europe. Of the wooden ships ow building in American yards 62 are accredited to ports of the New England and Iiddle Atlantic States. Of these all but one are to be under sail. A number of magazine rticles (among them, R. D. Paine's "Old Seaports Awakened," *Scribner's Magazine,* November, 1916) bear witness to general interest in this revival of a famous hereditary rade. On the contrary, most of the hundred vessels building in the ports of the South tlantic, Gulf, and Pacific States are under power. In this new policy of expansion

the United States has a rival in Japan. In 1916 the output of the latter's yards three times that of the previous year, and for the first time she appeared as a se of ships (*Commerce Repts.*, Dec. 27, 1916; Jan. 5, 26 and 27, Feb. 9, March 3, 191

Irrigation in the Okanogan Valley, Washington. The valley of the Okano River in Washington has been reclaimed for a distance of 30 miles south of the Canad boundary by means of irrigation works which were completed on July 7, 1916. thousand acres of land in the favored fruit section of the state are now available exploitation. The soil and climate of this valley are particularly favorable to ap growing, and the cattle ranges of the bordering hills will also encourage the raising valuable forage crops.

As described by J. C. Stevens in the *Engineering Record* for November 25, 19 the water is diverted from the Similkameen River at a point 11 miles above Orovi at which town it is distributed to three different sections of the region to be irrigat The main branch crosses the Similkameen River and is continued southward on west side of the Okanogan valley. A branch is also run on the eastern side of same valley, while another section runs northward as far as the Canadian bord The undertaking was noteworthy by reason of the rapidity of its completion, construct having begun and ended within a year's time despite the impediment of an unusua snowy winter. The financing of the project by the landowners exclusively is anot interesting feature. Some four thousand acres of the irrigated land are now un development.

Aërological Work of the U. S. Weather Bureau. *Supplement No. 3 of Monthly Weather Review* (1916) has the sub-title "Aërology No. 1" and is devoted several papers which deal with the meteorology of the free air. The present *Supplem* is the first of a series which will take the place, so far as the publication of free- data is concerned, of the former *Bulletin of the Mount Weather Observatory*, which no longer issued. A supplement in this aërological series is to be issued about once three months. The interruption of the free-air work owing to its transfer from Mo Weather to the Middle West has made it necessary to include in the present publicati all the data obtained in 1915.

The first article contains data obtained at Fort Omaha with *ballons sondes* ma in the United States. These balloons, it is noted, were not as well suited to the purp as those which had been imported from Russia before the war. The previous free- work at Fort Omaha had been done in summer, autumn, and winter. The observati here included were made in spring.

An unusual opportunity for securing ocean meteorological observations was p sented in the use of the U. S. Coast Guard cutter *Seneca* while that vessel was on i patrol duty in the North Atlantic. The Bureau of Standards, the Bureau of Fisheri and the Weather Bureau co-operated in securing the data. The work done by t Weather Bureau in securing free-air data is discussed in the second article in t present *Supplement.*

Free-air observations at Mount Weather were discontinued June 30, 1914, and ste were taken toward the establishment of several aërological stations on the plains of t Middle West. The third and fourth articles describe the station on Drexel Farm (miles west of Omaha, Nebr.) and give the free-air data obtained there during 191 Instead of millimeters of mercury, millibars are used in this publication.

R. DeC. Ward.

Sponge Fishery in the Bahamas. Sponges, sold on the market as "velvet" a "wool," constitute over half the exports of the Bahamas. For some years past t Marine Products Board has been investigating the decline in production of the latt or more valuable, class. The cause of the decline has now been definitely ascertain (*Annual Colon. Repts. No. 900*, London, 1916). The sponge is a parasitical growth a attaches itself to the conch shell naturally abundant in the current mud, the habit of the wool sponge. Constant removal by the sponge fishers has led to depletion of t supply of shells and consequently of sponge.

EUROPE

The Serbian Homeland. The country inhabited by Serbians, a well-defined regi in the western part of the Balkan Peninsula, is described by the eminent Serbia geographer, Professor Jovan Cvijić, in a book entitled "The Unity of the Southe Slavs" (in Serbian, Nish, 1915; abstracted by Emile Haumant in the *Annal. de Géog* for Nov. 15, 1915). According to this authority, the differences of topography a

imate in the Dinaric region are of a minor character and do no impair the unity of ie territory peopled by Serbians.

Three regions can nevertheless be distinguished in this area. The first, and largest, the country of mountains and plateaus between the Save and the Adriatic, which is ie real homeland of the race. Towards the northeast it faces the region of summer ainfall, and on this side is therefore covered by a pleasant mantle of vegetation, while ie southwestern half is, in general, bleak and barren. To the north lies the Pannonian asin, the second region. Its rivers are all directed towards Belgrade, which thus ecomes a natural center of activity. A steady emigration from the first to the second egion has taken place since the end of the period of Turkish invasions. The third egion is the relatively narrow coastal strip along the Adriatic, whose distinctive features re a Mediterranean climate and a karst topography, characteristic of limestone areas. [ere the area of agricultural land is small and this, according to Cvijić, forces the ihabitants to maintain relations with their kinsmen of the mountainous rearland. He ierefore holds that the intercourse of the coast people has been much more active ith the mountainous region back of them than with the opposite shore of the Adriatic, ı spite of the prolonged Italian control over Dalmatia.

In this diverse territory a single people, the Serbians, have maintained identity f customs and traditions. The literary language is the same everywhere. At the same ime the typical Serbian is the inhabitant of the *planina,* the plateau or block mountain. 'he majority of Serbian leaders have risen from this type.

Bulgaria's Forest Resources. Bulgaria's forests may be divided into four zones ccording to altitude. The lowest and warmest extends from sea level up to an altitude f 1,300 feet, and is the home of the oak, elm, and ash. Above this belt, up to a eight of 2,600 feet, is the oak-beech transition zone. Between 2,600 and 4,300 feet is he typical beech zone. It contains ample supplies of timber. Finally a pine zone, qually well stocked, extends between 4,300 and 6,600 feet.

According to a note published in *Commerce Reports* for January 30, 1917 (pp. 396-98), Bulgaria's forest area in 1908 comprised 7,086,232 acres, of which 1,611,423 were ational property. No statistics have been available since that date. The forests were hen valued at $125,000,000, but entire sections were destroyed during the Balkan wars f 1912 and 1913.

The deciduous varieties of trees predominate in the forests of the Balkan Range. 'he Stara Planina region, with its beeches, willows, and poplars, is typical. The conifer-us trees abound particularly in the Rilo and Rhodope Mountains. Access to the forested reas in Bulgaria is generally difficult. This condition accounts for the fact that some 30 per cent. of the total area of the country consists of forests.

ASIA

The Foreign Trade of Chinese Turkestan. Commercial and financial conditions in his region are summarized in the consular reports entitled "Indo-Yarkand Trade," eproduced in the *Board of Trade Journal* for Feb. 24, 1916, and Jan. 4, 1917 (see lso reports "Trade of Ladakh (Kashmir Province) with Central Asia" in Feb. 3, 1916, nd Dec. 28, 1916, issues of the same journal). Yarkand, at the western edge of the [arim Desert, in spite of poor communications, carries on a considerable trade with Russia, Afghanistan, and India. The trade route to India, via Leh, is one of the ighest and most arduous in the world. It crosses range after range to reach, in one of the Karakoram passes, its maximum altitude of 18,550 feet. Along it travel can be maintained for only six months in the year. A somewhat shorter and more accessible oad between Peshawar and Yarkand is used by Bajauris and other tribesmen of the Indian Northwest frontier. This route passes through Chitral and the Baroghil Pass of the Pamirs.

With Russia, communications present less difficulty. At least half a dozen trade roads connect Kashgar with the Russian provinces of Ferghaná and Semiryechensk. The main route runs across the Terek Pass at an altitude of 11,000 feet to the easterly continuation of the Trans-Caspian railroad, now open to within a short distance of the border. Yet another outlet will be afforded with the completion of the projected continuation of the Tashkent-Orenburg line along the northern foot of the Tian Shan. During the summer months, trade is also maintained with the province of Badakhshan, northeastern Afghanistan. The Afghan traders bring almonds, pistachios, and horses to exchange for Russian piece goods and carpets. The exports of Turkestan to Russia consist mainly of raw materials—cotton, silk, and wool, though the local white cloth and carpets constitute considerable items. The bulk of the imports is made up of cotton tissues. For the year ended March 31, 1916, the total value of the import trade

is estimated at from $1,750,000 to $2,000,000 (3,500,000 to 4,000,000 roubles) and t export trade at nearly $2,000,000.

Trade with India is not so extensive: it amounted to about $800,000 (2,437,3 rupees) in 1914-1915 and to less for the last financial year. Raw silk and *charas*, a dr extracted from hemp, constitute the principal exports. The value of the outgoing tra however, is usually inferior in value to the incoming, and the deficiency is made up l export of bullion as well as by bank drafts and money orders. Cotton piece-goods of Briti and Indian manufacture form the chief imports. From Assam are sent skins which pr vide the fur used around the headpiece worn by the natives of High Asia. An eve increasing consumption of spices from southern India obtains in Chinese Turkestan a the western provinces of China. It is surpising to find that Japanese cotton and si prints as well as Chinese silk reach Yarkand by way of the roundabout Indian rout

Salt Production in China. The introduction of recent administrative reforn calls attention to the salt industry, China's second largest source of revenue (E. Cunningham: Chinese Methods of Salt Production, *Commerce Repts.*, July 25, 1916 While the productive districts are widely scattered, the chief source lies round Tzu Li Ching in the hills of Szechuen, between Chengtu and the treaty port of Chungkin The annual production of the province is estimated at over 300,000 tons, of which ov a fifth is available for export to neighboring regions. This large output is obtained b very ancient and primitive methods of extraction. Thus, water buffaloes supply the moti power for pumping the brine from the deep wells—some are over 3,000 feet deep— drilled in the first instance by the methods of ten centuries ago (H. K. Richardson The Salt-Wells of Tzuliutsing, *Scientific American Suppl.*, Nov. 18, 1916). The intr duction of modern machinery will depend, however, not only upon geographic factor chief of which is transportation costs in the canyoned country of the upper Yangtz River, but also upon the attitude of the Chinese government, the ultimate control o all matters pertaining to the salt industry.

An interesting contrast in methods of salt getting is illustrated in the *Scientif American* for December 16, 1916, in an article entitled "How Salt is Extracted from t Great Salt Lake."

Food-Plant and Wood Resources of the Philippines. Two recent publications o the Department of the Interior in Manila should prove useful in any study of th material resources of the Philippines. "The Food Plants of the Philippines," by P. Wester (*Philippine Agric. Rev.*, Vol. 9, 1916, No. 3), replaces the description of th economic plants of the islands made by the Bureau of Agriculture twelve years ag Since that date many useful indigenous species have been discovered and many exoti have been successfully introduced. Yet despite the wealth of food plants and the favor able conditions for their cultivation, the Philippines annually import large quantitie of foodstuffs that could be produced at home. During 1915 importations of this cla amounted to $8,000,000, or about one-sixth the total imports. Production has kept pac with the increase in population, but beyond this "does not appear to have increase materially during the last ten-year period."

"Commercial Woods of the Philippines: Their Preparation and Uses," by W. F Sherfesee (*Bur. of Forestry Bull. No. 14*, 1916), is a comprehensive work writte mainly from the point of view of the wood user. It embraces a general description o the status of the industry in the islands, discussions of the properties, uses, and distin guishing characteristics of the woods, and a detailed description of some 360 species.

WORLD AS A WHOLE AND LARGER PARTS

Racial Migrations Before the First Siege of Troy. The first siege of Troy was not the one described by Homer but a much earlier one, prior to 2000 B. C., according to a recent article by Harold Peake (Racial Elements Concerned in the First Siege of Troy, *Journ. of the Anthropol. Soc. of Great Britain*, Vol. 46, 1916, pp. 154-172.) Mr. Peake takes this siege as his point of departure, but his chief concern is the various migrations which may have led up to it. This leads him to discuss the origin and spread of the Nordics along the lines followed by Mr. Grant in his book on "The Passing of the Great Race" (see the review in the December *Review*, pp. 477-478, and the article, with maps, in the November *Review*, pp. 354-360). Incidentally Mr. Peake suggests that the blondness of the Nordics is not necessarily due to long residence in a cool, humid climate. There is considerable evidence that the Nordics originated in Russia east of the Dnieper River. On the dusty steppes and barren tundras, which were prevalent there in the Reindeer Period, natural selection may have caused the hair and complexion of the Nordics gradually to acquire the khaki shades which would be the most protective

that particular environment. This is merely a suggestion, and the author does not sist upon it.

Coming to his main object Mr. Peake shows that shortly before the first siege of roy there occurred a number of great migrations which were apparently due to a eriod of drought. In his book on "Palestine" the writer has suggested that the anaanite invasions of Syria and Mesopotamia may indicate a dry period culminating bout 2400-2500 B. C. Such a period would naturally cause other migrations. Mr. eake points out that recently discovered facts point to several such migrations. For stance, about 2450 B. C. Canaanite tribes from Arabia crossed the Sinaitic peninsula nd occupied the Egyptian delta, just as others a little later invaded Palestine and yria, bringing with them the knowledge of metals and founding Damascus. Again, about 00 B. C., drought apparently caused the Bak tribes east and southeast of the Caspian ea to migrate northeastward and finally to reach China, where they established a ynasty about 2000 B. C. At approximately the same time the Nordics seem to have igrated from the Volga steppes. Some went east to Persia, where we find them later the Cassites. Others passed through Galicia to Rumania and thence across the alkans. Part went down the east coast of Greece to Thessaly, while others crossed ne Hellespont and destroyed Hissarlik II, the predecessor of Homer's Troy. Thus l over the ancient world there was a great wave of migration a little more than 4,000 ears ago, just as there was again about 1200 B. C. and a third time a few hundred ears after Christ. ELLSWORTH HUNTINGTON.

POLAR REGIONS

A Third Relief Expedition for the Crocker Land Party. It will be recalled *Geogr. Rev.*, Vol. 1, 1916, pp. 145-146, and Vol. 2, 1916, pp. 65 and 471) that two ttempts have already been made to relieve the marooned members of the Crocker Land xpedition in northern Greenland. The first relief ship, the *George B. Cluett*, sent out the summer of 1915, was caught in the ice, broke her engine shaft, and was forced spend the following winter in Parker Snow Bay (76° N. and 68½° W.), 37 miles est-northwest of Cape York, at the southern entrance to the restricted waters which ad from Baffin Bay to the Arctic Ocean. Because she did not return as expected, in e autumn of 1915, it became necessary to send a second relief ship, and the steamer *anmark* of the Greenland Mining Company was chartered for this purpose and sent north the summer of 1916. Her failure to return last fall indicates that she, too, has been rced by the ice conditions to winter in the north. She was last reported on August 20, 916, in Melville Bay, bound north, having made only 150 miles in the preceding seven-een days. It is not even known whether she reached North Star Bay (in Wostenholme ound, 76½° N., on the other side of the peninsula from Parker Snow Bay), the head-uarters of the six remaining members of the expedition, among whom are Dr. Hovey, IacMillan, and Ekblaw.

The probability is that some of these men, as Green, Allen, and Tanquary did last ear, are sledging down the coast to reach one of the settlements in southern Greenland. rdinarily a cable message from them might be expected about the middle of May, via ne Faroe Islands, giving information as to the condition of the party and the necessity or sending a relief ship or not. Now, however, as our Society is informed by the Acting hairman of the Committee in Charge, the Danish Government announces that owing to ar conditions the usual sailing of its supply vessels to Greenland has been postponed. his means that if any members of the expedition sledge down to southern Greenland, here will be no way for them to come out or even to send a message. Under these ircumstances the committee is proceeding to charter a third vessel and despatch her orth to make certain of the return of the members of the expedition this summer. All ossible ships are now being canvassed, and it is hoped it will be possible to secure one f the Newfoundland sealers. These boats are equipped with wireless and have adequate team power. The vessel will leave St. John's early in July and it is hoped she will eturn by late August.

While the failure of the *Danmark* to bring back the explorers is a keen disappoint-ent, no grave anxiety need be felt for their safety. The *Danmark* has ample provi-ions, and, even if she should not have reached North Star Bay, it is highly probable hat contact has been established with the marooned men and that they are in far more omfortable quarters than last winter.

ECONOMIC GEOGRAPHY

The Economic Significance of the Time of Rainfall. An important and sug-gestive study of daytime and night-time precipitation and the economic significance of

the diurnal distribution of rainfall has been made by J. B. Kincer (Daytime and Nigl time Precipitation and Their Economic Significance, *Monthly Weather Rev.*, No 1916). The subject is one which has thus far received little attention. Rainfall data f Lincoln, Nebr., Evansville, Ind., and Thomasville, Ga., are shown in diagrams. Thr charts give the average precipitation (for the United States) in inches during the da 8 A. M. to 8 P. M. and night, 8 P. M. to 8 A. M. for the season, April to September, inc 1895-1914; and also the percentage of the average precipitation for the season, as abov that occurs at night. Many interesting facts are brought out in the discussion. In the Ce tral Plains the greatest concentration of night rains occurs in the harvesting and threshi season. Daytime rains are then comparatively infrequent. The economic bearing of th condition is obvious. There is the least possible interruption of harvesting operatior and the fact that the summer showers come chiefly at night means that less water evaporated than would be the case under sunshine. In the southeastern states summ rainfall is usually plentiful, so that the question of the diurnal distribution is of mu less economic importance so far as crops are concerned. R. DEC. WARD.

Weather Insurance. The whole question of insuring agricultural products again damage or loss because of unfavorable weather is one to which increasing attentic is certain to be paid in the immediate future. Man cannot prevent the occurrence o most of the unfavorable meteorological conditions which result in the injury of h crops, although protection against frost is a striking illustration of a successful car paign which, in the United States especially, has over and over again proved its efficac William G. Reed, of the U. S. Office of Farm Management, has been giving attentic to weather insurance as a phase of the business side of farming (Weather Insuranc *Monthly Weather Rev.*, Oct., 1916; with H. R. Tolley: Weather as a Business Risk i Farming, *Geogr. Rev.*, July, 1916). It is believed that the apparent capriciousness of tl weather and the fact that weather conditions are generally widespread account fo failure to establish any successful plan for insurance against unfavorable weather. Tl author is of opinion that the weather hazard can be determined with such accuracy i many instances that insurance against the occurrence of killing frost or other unfavo able weather condition may be arranged on a sound business basis, and not as gambling operation. R. DEC. WARD.

GEOGRAPHICAL NEWS

A French Prize in Pre-Columbian American Archeology. According to a announcement just received from the Bibliothèque Nationale of Paris, the Prix Angran of the value of 5,000 francs, will be awarded in 1918 for the best work published durin the five years 1913-17 on the Pre-Columbian history, ethnography, archeology, o linguistics of the American aborigines. Candidates should submit ten copies of the work to the Secrétariat of the Bibliothèque Nationale before January 1, 1918. A jur of eighteen members, including representatives of the Geographical Society of Pari (two) and of geographical and anthropological societies outside of France (up to fiv members), will pass on the works submitted.

PERSONAL

PROFESSOR RAOUL BLANCHARD, professor of geography at the University of Grenobl whose appointment as visiting professor from France at Harvard University for th current semester was noted in the February *Review* (p. 155), gave an illustrated lectur in French at Columbia University on March 26 entitled "Flanders as a Theater o Military Operations." Professor Blanchard briefly described the natural divisions o Flanders and then vividly pointed out how completely the physical features of th region have influenced military operations during the present war.

MR. N. H. DARTON of the U. S. Geological Survey gave a lecture on March 9 a Lehigh University on "The Grand Canyon of Arizona: A Great Object-Lesson i Geology and Geography." Many new views and other illustrations were shown.

MR. CHARLES WELLINGTON FURLONG, F.R.G.S., gave a lecture on April 4 before th Geographical Society of Philadelphia entitled "Chile and the Fuegian Archipelago." Mr. Furlong's lecture dealt with the topics treated in his two recent articles in th *Review* ("Some Effects of Environment on the Fuegian Tribes," January, 1917, an "Tribal Distribution and Settlements of the Fuegians," March, 1917).

DR. J. J. GALLOWAY read a paper before the New York Academy of Sciences o March 17 entitled "The Physiographic History of the Nashville Basin." The pape was illustrated with charts and maps.

Mr. Leo E. Miller of the American Museum of Natural History gave an illustrated ‹cture before the Linnaean Society of New York on March 13 entitled "A Bird's-eye ‹iew of South America." Mr. Miller's lecture was based on the experiences of his ‹ölogical trips in South America. The present number of the *Review* contains the first ‹ two articles on one of these trips, up the Orinoco in 1912-13. The March, 1916, ‹umber had an article from his pen entitled "The Descent of the Rio Gy-Paraná," ‹hich gave an account of his activities on the Roosevelt-Rondon expedition of 1914.

Hon. Robert Sterling Yard of the newly created National Parks Service spoke ‹ March 17 before the Geographical Society of Philadelphia on "Our National Parks." ‹revious reference to this speaker and the government bureau with which he is connected ‹as made in the February *Review* (p. 155).

Obituary

Colonel Charles Chaillé-Long died on March 24 at Virginia Beach near Norfolk, ‹a., in his seventy-fifth year. He was best known to geographers for his explorations in ‹e upper Nile basin. As an officer of the Egyptian army and chief of staff of General ‹then Lieutenant Colonel) Gordon he conducted an expedition in 1874 from Gondokoro ‹5° N.) on the upper Nile to Lake Victoria, on which his route first paralleled the Nile ‹ a south-southeastward direction to Dufile (3½° N.), then led south cross-country to ‹e river's bend at Foweira (2¼° N.), and thence south to the northern shore of ‹ake Victoria at Murchison Bay. On his return he traveled northeast until he struck ‹e Nile, here the outlet of Lake Victoria, at Urondogani (¾° N.). Above this point ‹e river had been explored up to the lake by Speke on his memorable voyage in 1862. ‹haillé-Long now descended the river, which soon entered a large swamp-bordered and *‹udd*-infested lake, which he named Lake Ibrahim (now known as Lake Choga). Finally ‹n outlet was found, which proved to be the Nile, and this was descended to Foweira, ‹hence the return was made overland to Gondokoro. By this trip the identity, already ‹onjectured, of the Victoria Nile with the river, discovered by Baker in 1864, which ‹ssued from Lake Albert, was definitely established and a new lake discovered in the ‹ystem of reservoir-lakes which are the main feeders of the great river. In recognition ‹f these additions to geographical knowledge the Charles P. Daly Medal was awarded ‹y this Society in 1910 to Colonel Chaillé-Long (see the account in *Bull. Amer. Geogr. ‹oc.*, Vol. 42, 1910, pp. 205-207).

In 1875 Colonel Chaillé-Long made another trip from Gondokoro which led him west-‹outhwest along the Congo-Nile divide region, carrying him across the upper tributaries ‹f the Bahr-el-Ghazal system to a point connecting with the farthest southeast of ‹chweinfurth's route in 1870. The most important of Colonel Chaillé-Long's geograph‹cal works are "Central Africa: Naked Truths of Naked People," with route map, New ‹ork, 1877; "Les Sources du Nil," Paris, 1891; "L'Égypte et Ses Provinces Perdues," ‹aris, 1892 (the Society's copy bears author's autograph).

Mr. Willard D. Johnson, long connected with the U. S. Geological Survey as ‹opographer, died in Washington on February 13 at the age of fifty-seven. His first ‹ork on the Survey was under G. K. Gilbert in 1879-80, on Lake Bonneville. He was ‹ppointed assistant topographer in the Topographic Branch in 1882, and continued in ‹hat branch of the service until 1896, working his way up through the various grades. ‹rom 1888 to 1890 he was in charge of the topographic surveys of the drainage basin ‹f the Arkansas River in Colorado. In 1891 he was placed in charge of the California ‹ffice of the Survey, which position he held for three years. He was one of the charter ‹embers and director of the Sierra Club in 1892. In 1895 he accompanied as ‹opographer the hazardous expedition of the Bureau of Ethnology under W J McGee ‹o study the Seri Indians, a savage tribe inhabiting Tiburon Island in the Gulf of ‹alifornia and the opposite mainland in Sonora, Mexico (see W J McGee: The Seri ‹ndians, *17th Ann. Rept. Bureau of Amer. Ethnol.*, 1895-96, Pt. I, pp. 1-344* [duplicate ‹agination], and W J McGee and W. D. Johnson: Seriland, *Natl. Geogr. Mag.*, Vol. 7, ‹896, pp. 125-133). Mr. Johnson joined the Water Resources Branch of the Survey ‹n 1897, working in Oklahoma on the underflow water of the Arkansas River and allied ‹roblems of the Great Plains. As a result of this work he published an extended ‹eport on "The High Plains and Their Utilization" (*21st and 22nd Am. Repts. U. S. ‹eol. Survey*, 1899-1901, Pt. IV in each, pp. 601-741 and 631-669, respectively). From ‹901 to 1904 he was in Utah. In 1905 he changed from topography to geology, and ‹ook up work in the Sierra Nevadas, studying chiefly the glacial geology. As a result ‹f these studies, he formulated his theory of *bergschrunds* (see W. H. Hobbs: Char‹cteristics of Existing Glaciers, New York, 1911, pp. 15-17, with references). Later, ‹n 1907, he studied the displacements of the earthquake of 1872 in Owens Valley, but

his efforts were very much hampered by illness. During 1912, 1913, and part of 19 his health did not permit steady work, but in the spring of 1914 he came to Washingt and was given the position of geographer in the Forest Service at Portland, Oreg He left there and returned to Washington in 1916 and, in ill health, was confined in hospital. He was released from there during the summer of 1916, and was working a model of the Grand Canyon at the time of his death.

Mr. Johnson had unusual ability as a teacher of the science of topographic engine ing and untiring energy in every work he undertook. While connected with the To graphic Branch he did perhaps more than any other topographer to improve the metho of topographic map-making to its present high standard. He seemed to have no thoug for anything but the advancement of the scientific work of the Geological Survey, sac ficing his health, pleasures, and means to that end. He invented and patented abo 1887 a new style of plane-table tripod, known as the "Johnson Plane-Table Mo ment," the advantages of which were so evident that it was at once adopted by t Geological Survey, and it has been the standard in use since patented. He waived l royalty to the government for all tripods needed. Another invention which he ga to the government is the paper-holding thumb-screws for use in plane-table boar Thousands of these have been made for the Survey, and they are now standard equi ment for such purposes all over the United States. Many other devices and metho proposed by him have had their effect on all the topographic work of the Geologic Survey for the past thirty years.

Mr. Johnson's keen appreciation of topographic forms found graphical expressi in his maps. Possibly the best examples of these are the admirable map of Serilan 1:380,160 (Pl. 1, Pt. I, *17th Ann. Rept. Bureau of Amer. Ethnol.*), a pen-and-i drawing of great delicacy, and the map of the High Plains, 1:6,000,000 (Pl. CXII Pt. IV, *21st Ann. Rept. U. S. Geol. Survey*), with relief in shading, which is the be general representation of the region.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

CANADA

General

LLSON, BECKLES. **The life of Lord Strathcona and Mount Royal, G. C. M. G., G. C. V. O.** Vol. 1, xiv and 544 pp.; Vol. 2, 533 pp. Houghton Mifflin Co., Boston, [1915]. $6.50 per vol. 9 x 6.

The author of this work is a past master of Canadian history nd a voluminous ter on Canadian affairs. Sound judgment characterizes his productions. In prepar- these volumes there was at his command much of the correspondence affecting the nifold activities of Lord Strathcona, as well as the assistance of the latter's near tives and intimate friends. Of particular value was the unreserved use of the copious vate and official correspondence carried on between the Premiers of Canada and d Strathcona during his term of office as High Commissioner. The result is a most resting, authoritative, and illuminating story of the life and achievements of the n who has contributed more than any other to the material development and national of Canada.

Donald Alexander Smith was born of humble parents in the town of Forres, Scot- d, in 1820. He went to Canada in 1838, the first year of the reign of Queen toria, and entered, at once, the service of the Hudson's Bay Company. His advance- nt proceeded apace, until he reached the office of Chief Commissioner. In 1873, ause of his absorbing interest in Canadian finance and politics, he retired from the erintendency of the fur trade. Throughout his whole life, his activities were closely ntified with the development and control of such fundamental Canadian institutions the banking system, railways, immigration, the fur trade, and public education; , as a member of the Dominion parliament and finally as High Commissioner for ada in London, he exercised a controlling influence in molding the political policies the Dominion. In the words of the author, "he saw the growth of Canada's first od of great prosperity, to which his own efforts had in full measure contributed, he died on the eve of a new era when our people, stimulated by his teaching and example, sanctified forever, by thousands of lives and millions of money, the bond ch binds them to the British Empire."

Parts of the work are of much interest and value to students of Canadian geography. re are pen pictures of various regions surrounding the posts of the Hudson's Bay npany and of the difficult life conditions which prevailed there before the introduc- of modern systems of transportation. The volumes are liberally interspersed with acts from letters and reports which the author handles so skillfully as to make them an added interest to his own story. In such extracts, often from the pen of Lord thcona himself, we find detailed observations upon the physical conditions of regions upon the customs of the various Indian tribes inhabiting the areas served by the lson's Bay Company. In the story of the series of events which make up the history hat part of the Northwest in which Lord Strathcona was closely identified, we find h to interest the student of economic geography. The usefulness of the volumes ld have been greatly enhanced, both for the general reader and the close student anadian affairs, to whose interests the work is best adapted, had there been included e and larger maps containing the names of places and regions mentioned in the text.

AVARD L. BISHOP.

ÉDARD, AVILA. **La forêt et la houille blanche.** *Bull. de la Soc. de Géogr. de bec,* Vol. 10, 1916, No. 2, pp. 76-79.

ADELL, H. M. **The resources of Canada.** Maps, ills. *Scottish Geogr. Mag.,* Vol. 1916, No. 3, pp. 113-130; No. 4, pp. 173-187.

—— **Canada, Fifth census of, 1911. Vol. 6: Occupations of the people.** xxxi 469 pp. J. de L. Taché, Ottawa, 1915. [Statistics of people gainfully employed e nine provinces: the Yukon and Northwest Territories are excluded.]

—— **Canada: A summary of its history and economic possibilities.** I *Scientific American Suppl.*, No. 2142, Vol. 83, 1917, Jan. 20, pp. 40-42.

—— **Canada's gold and silver production.** *Commerce Repts.*, 1916, No. p. 1171. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washingt D. C. [Reprinted from *Monetary Times of Canada*, March 17.]

Fernow, B. E. **Co-operation in forestry.** 9 pp. Commission of Conservati Ottawa, 1915. [Reprinted from the sixth annual report of the Commission.]

—— **Fisheries Branch, Forty-ninth annual report of the, Department of t Naval Service, 1915-16.** lvi and 443 pp.; ills. J. de L. Taché, Ottawa, 1916. ["T total marketed value of all kinds of fish, fish products, and marine animals, taken Canadian fishermen from the sea and inland lakes and rivers, during the fiscal y ended March 31, 1916, amounted to $35,860,708, which gives an increase of $4,596,(over the total for the preceding year. The greater part of the large increase attributable to British Columbia, which alone gives an increase of $3,023,234 over l year."]

Foster, J. G. **Canada.** 15 pp. *Suppl. to Commerce Repts.*, Ann. Series, 19 No. 23a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washingt D. C.

—— **Geographic Board of Canada, Fourteenth report of the, containing decisions to March 31, 1915.** 273 pp. Dept. of the Interior, Ottawa, 1916.

—— **Geographic Board of Canada: Decisions: (1) November-Decemb 1915, 4 pp.; (2) January, 1916, 4 pp.; (3) April-May, 1916, 4 pp.; (4) June-Se tember, 1916, 1 p.** Extracts from *The Canada Gazette*, Jan. 8, Feb. 5, May 27, Se 16, 1916. Ottawa.

—— **Geographical material on Canada.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. pp. 82-89. [Extracts from the address of Prof. Frank D. Adams of the Royal Soci of Canada, 1914, and abridgments from the Canadian Commission of Conservat Reports (see a number of items listed in the June, 1916, *Review* on p. 467), "Sea Fi eries of Eastern Canada," 1912, and "Fur Farming in Canada," 2nd edition, 191

EUROPE

Balkan States, including Rumania

Botsford, G. W., and E. G. Sihler, edits. **Hellenic civilization.** xiii and 719 p index. (Series: Records of Civilization: Sources and Studies; edited by J. T. Sh well.) Columbia University Press, New York, 1915. $3.75. 9½ x 6.

The wonderful story is told in these pages of a civilization which flourished o 2,500 years ago and which has left a memory of itself in the arts and traditions our times. The book has been planned in keeping with the modern spirit of histo The activities of the people have been held to be of greater importance than the gl of leaders and grandees. By gauging accurately the democratic ideas which permea intellectual thought in those early days, the authors have opened the main road to understanding of what Hellenism meant to later generations. To Hellenic students discussion of sources which forms the text of the first chapter will perhaps be c sidered as the most valuable part of the entire work.

The geographer, no less than the layman, will find Hellenic views on the form a size of the earth of particular interest not only because, at a distance of twenty-f centuries, they indicate soundness of scientific reasoning on the part of leading think but mainly on account of their close relation to modern beliefs. The possibility reaching India by sailing west across the Atlantic had occupied Eratosthenes' mind early as 200 B. C., while Strabo, whose familiarity with the scientific achievements the Alexandrian age appears throughout his writings, supplies his contemporaries w evidences of the rotundity and size of the earth. But, beyond the field of scien delightful sidelights on ancient Greek customs and characters can be culled from assembled selections.

Such an attempt to depict Hellenic life and thought from within places readers English under a debt of gratitude to the authors. But the analogies with our o civilization are so numerous that one wonders whether, in the process of being sift through modern minds, a few particles of contemporary thought have not incrus themselves more firmly than necessary on this ancient material. We can, at any ra imagine Sappho gazing from Elysian heights and wondering at the changed spirit time as reflected in the selection of passages relating to her school as well as the co ment thereon.

[DW]IGHT, H. G. **Constantinople, old and new.** xxi and 567 pp.; ills., index. Charles Scribner's Sons, New York, 1915. 9½ x 6½.

The book is a pleasant and not overweighty addition to a Turkish shelf. The author, self-styled impressionist, makes no attempt to hide his reluctance to attain the truth it lies concealed beneath appearances. Having had the utmost opportunity to become miliar with the life of the great city, he has set himself with commendable zeal to part its charm to others. In spite of a certain monotony of style the work is redolent th subtle emanations of the rare and intangible spirit of the East. The publishers ve been fortunate in striking the same note in the general presentation of the book. ie net result of all this is that, like Constantinople, the book makes a strong appeal first inspection, but leaves the rambler in its haunts with a sense of unfulfilled expec- tion.

The reproduction of the mythical tale of the foundation of Byzantium is pardonable one who does not claim to be a historian. Nevertheless stray blemishes like these in iat is otherwise an excellent book invite comment. For, Mr. Dwight to the contrary, amboul does happen to be built on more than two hills. His eye must have been igularly blind to topography to have failed to observe that every important mosque the Turkish quarter crowns a hill. Most of these sanctuaries have been built on a mmanding site with the same deliberate forethought which presided over the housing the German Embassy in a reduced reproduction of the Wilhelmstrasse Foreign Office ected over the European heights overlooking the lower Bosporus.

Too great reliance on von Hammer's work is manifested in the frequent mention of name. This is somewhat out of place in the light of modern knowledge. However, observant reader will take Mr. Dwight's history very seriously. Gratitude to the thor for some exceedingly entertaining pages will prevail over other feelings. Per- ps a little surprise will be felt at the thought that the scion of a line of missionaries ould have taken it upon himself to become the apologist of the sanguinary Turk.

[G]ÉCHOFF, I.-E. **L'Alliance Balkanique.** viii and 252 pp.; map. Hachette & Cie., Paris, 1915. Frs. 3.50. 5 x 7½.

A valuable personal narrative by one of the makers of contemporary Balkan history. uch light is shed on the traditional enmity between Serbians and Bulgarians, which led the second Balkan war. In a way, the stand and aims of the great powers of Europe e also revealed. In the background of the tale, although unrecorded in its pages, looms e secular feud between Slav and Teuton for the possession of Balkan highways. Like- se, international relations between peninsular nations are shown to have been influenced this fact.

That the views presented are pro-Bulgarian is to be expected. The conformity Bulgarian interests to Teutonic aims explains the readiness with which the Slav state inged into what for its citizens was an anti-racial alliance, with the powers of Central irope. The chief interest of the book, however, lies in its discussion of Serbo-Bulgarian ontiers and the partition of Macedonia between the two rival countries.

BALDACCI, ANTONIO. **Nell' Albania settentrionale: Itinerari del 1897.** *Boll. della ale Soc. Geogr.,* Vol. 4, 1915, No. 11, pp. 1141-1180; No. 12, pp. 1214-1250; Vol. 5, 16, No. 1, pp. 5-27; No. 2, pp. 82-100. Rome.

BALDACCI, A. **Nell' Epiro turco e greco: Itinerari albanesi del 1895.** *Boll. lla Reale Soc. Geogr.,* Vol. 5, 1916, No. 3, pp. 164-200; No. 4, pp. 323-336; No. 5, . 368-384. Rome.

B[ELTRÁN Y] R[ÓZPIDE], R[ICARDO]. **Datos geográfico-económicos de Rumania.** *v. de Geogr. Colon. y Mercantil,* Vol. 13, 1916, No. 4, pp. 134-141. Real Soc. Geogr., idrid. [From report by the secretary to the Embassy in Bukharest.]

BLINK, H. **De Roemeniërs.** *Vragen van den Dag,* Vol. 31, 1916, No. 10, pp.)-779. Amsterdam.

CARAPATEAS, SOTIRIS. **Kalamata Agency.** *Suppl. to Commerce Repts.,* Ann. Series, 16, No. 7a, pp. 9-12. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, ishington, D. C.

CHRISTOFA, A. P. H. **Mitylene Agency.** *Suppl. to Commerce Repts.,* Ann. Series, 16, No. 7a, pp. 13-14. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, ishington, D. C.

COOKE, A. B. **Patras.** *Suppl. to Commerce Repts.,* Ann. Series, 1916, No. 7a, . 14-20. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, C.

AUSTRALASIA AND OCEANIA

Australia, New Zealand

Hunt, H. A. **Results of rainfall observations made in New South Wales duri 1909-1914. Also, as an appendix, results of meteorological elements a normals at Sydney from 1840.** 224 pp.; maps, diagrs. Commonwealth Bur. Meteorol., Melbourne, 1916.

In 1909 the Australian Commonwealth Bureau of Meteorology published a volu containing the results of its rainfall observations in New South Wales, and now we h a new report, which brings the "rainfall history" of that same district up to the of 1914. Similar volumes are to be printed every five years, not only for this one st but for all the states of the Commonwealth. The criticism so often made regarding failure of meteorological services to publish their observations promptly can surely be brought against the Australian bureau. In this volume we have the usual notes the general character of the rainfall of each year and of each month; tabular stateme of rainfall at some 2,100 stations for 1909-1914 inclusive; and annual averages c puted from the beginning of the period over which the records extend. Rainfall m are given for each of the years 1909-1914, and on these the areas with rainfall above average are tinted. This seems to us an excellent scheme. It emphasizes excess annual rainfalls without in any way interfering with the clearness and general usefuln of the maps. Two of the other maps deserve special mention. One shows the num and distribution of severe hailstorms for the years 1888 to 1913. On this—a uni feature, so far as we can recall—the sizes of the hailstones are indicated by symb e. g., marbles to nutmegs, pigeon's eggs to hen's eggs, and turkey's eggs to croq balls. We count about twenty-five cases in which the hailstones were described as be between turkey's eggs and croquet balls in size! A chart of economic interest is showing the average rainfall for the wheat-growing period (April to October).

This volume, like the rest of the Australian reports which have preceded it, is int esting (a characteristic none too common in meteorological publications) because emphasizes the economic importance of rainfall. R. DeC. Ward.

Waldron, J. J. **Central Australia: The Macdonnell Ranges and surrounding co try, having in view the possibility of railway extension from Oodnadatta Alice Springs.** 50 pp.; maps, ills. Publ. under the authority of Hugh Mal McCarron, Bird & Co., Melbourne, 1916. 9 x 5½.

In the words of the author, the aim of this instructive pamphlet is "to assist in s slight degree to arouse public interest in the future of Central Australia." Conditi which the settler must face are neither minimized nor exaggerated. The possibilities the region, so clearly stated, are shown to be especially favorable to the raising of she horses, and cattle, as well as for limited soil crops. Gold, mica, and probably ot minerals, though not in abundance, under proper conditions can be mined in well-pay quantities.

A plea is made for the boring of sub-artesian and artesian wells as a solution of water-supply problem, and for the construction of a railroad from Oodnadatta, the p ent terminus of the railroad north from Adelaide, to at least Alice Springs in the M donnell Range, a distance of about 335 miles. The arguments in behalf of both of th improvements are convincing.

The booklet is one of the best short pieces of literature giving a concise and vi picture of interior Australia which has appeared in recent years. It is based wholly geographical factors and accordingly might well be termed "A Brief Geography of C tral Australia." At the end of the pamphlet two folded maps are inserted, one show the location of Central Australia in relation to the Commonwealth and the ot representing in detail the territory discussed. Eugene Van Cleef

Melanesia, Micronesia, Polynesia

Brown, J. M. **Aboriginal decay in the Pacific Ocean.** *Journ. of Race Dev* Vol. 6, 1916, No. 3, pp. 277-284. [Cf. review of "The Dutch East," by the sa author, in the March, 1916, *Review* (Vol. 1, p. 240).]

Cremers, A. C. C. **Grepen uit de militaire exploratie van West-Nieuw-Guin** *Indisch Genootschap*, 1915, Nov. 22, pp. 25-50.

Fallaize, E. N. **The Routledge expedition to Easter Island.** *Nature*, 2430, Vol. 97, 1916, May 25, pp. 261-262.

Fornander, Abraham. **Fornander collection of Hawaiian antiquities and fo lore: The Hawaiian account of the formation of their islands and origin of th**

ice, with the traditions of their migrations, etc., as gathered from original ources. With translation revised and illustrated with notes by T. G. Thrum. 173 pp.; s. *Memoirs of the Bernice Pauahi Bishop Museum,* Vol. 4, 1916, Part 1. Honolulu, 916.

FRICKE, KARL. **Die Sisalkultur auf den Fidschi-Inseln.** Ills. *Der Tropenpflanzer,* ol. 19, 1916, No. 2, pp. 88-94.

GEROULD, K. F. **By-ways in Hawaii.** Map, ills. *Scribner's Mag.,* Vol. 59, 1916, o. 6, pp. 717-735.

GEROULD, K. F. **Honolulu: The melting-pot.** Ills. *Scribner's Mag.,* Vol. 59, 916, No. 5, pp. 517-537.

GEROULD, K. F. **Kalaupapa: The leper settlement on Molokai.** Ills. *Scribner's ag.,* Vol. 60, 1916, No. 1, pp. 1-18.

—— **Gilbert and Ellice Islands protectorate: Report for 1914-15.** 17 pp. *Ann. olonial Repts. No. 884.* London, 1916. [A note on the annexation of the island groups ppeared in the February, 1916, number of the *Review* (Vol. 1, p. 145).]

GRIFFITHS, A. F. **The Japanese race question in Hawaii.** *Journ. of Race Devel.,* ol. 6, 1916, No. 4, pp. 422-440.

HAZARD, D. L. **Results of observations made at the United States Coast and eodetic Survey Magnetic Observatory near Honolulu, Hawaii, 1913 and 1914.** 5 pp.; diagrs. *U. S. Coast and Geodetic Survey Series No. 21.* Washington, D. C., 916.

JAGGAR, T. A., JR. **Weekly Bulletin of the Hawaiian Volcano Observatory.** ap. Vol. 4, 1916, No. 7, pp. 61-70. Hawaiian Volcano Research Assoc., Honolulu.

LAYTON, T. B. L. **Society Islands.** 6 pp. *Suppl. to Commerce Repts.,* Ann. Series, 916, No. 62a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washgton, D. C.

MACCAUGHEY, VAUGHAN. **The coral reefs of the Hawaiian Islands.** *Journ. of eogr.,* Vol. 14, 1915-16, No. 7, p. 252.

MACCAUGHEY, VAUGHAN. **The little end of Hawaii.** *Journ. of Geogr.,* Vol. 15, 916-17, No. 1, pp. 23-26.

MACCAUGHEY, VAUGHAN. **The Punchbowl: Honolulu's metropolitan volcano.** ap, ills. *Scientific Monthly,* Vol. 2, 1916, No. 6, pp. 607-613.

MARCADÉ, CH. **Régime des vents et marche des cyclones dans les parages de archipel des Tuamotu.** Map, diagrs. *Annales Hydrogr.,* Ser. 2, Vol. 35, 1915, pp. 7-91. Serv. Hydrogr. de la Marine, Paris.

MATTHEW, W. D. **The origin of Pacific island faunas.** *Science,* No. 1115, Vol. 3, 1916, May 12, p. 686. [Letter to the editor.]

RANKINE, R. **Fiji: Report for 1915.** 15 pp. *Ann. Colonial Repts. No. 887.* London, 1916.

RAUWS, JOH. **Nieuw-Guinea als Zendingsterrein.** *Med. Nederl. Zendelingenootschap,* Vol. 60, 1916, No. 2, pp. 133-153. Rotterdam.

SCHUCHERT, CHARLES. **The problem of continental fracturing and diastrophism Oceanica.** Maps. *Amer. Journ. of Science,* No. 248, Vol. 42, 1916, pp. 91-105.

WOOD, H. O. **Reconnaissance of the Kahuku flow of 1916.** *Weekly Bull. Hawaii Volcano Obser.,* Vol. 4, 1916, No. 6, pp. 51-58.

EDUCATIONAL GEOGRAPHY

RIGHAM, A. P., AND C. T. MCFARLANE. **Essentials of geography. Book I:** vi and 266 pp.; maps, diagrs., ills., index, bibliogr. **Book II:** vi and 462 pp.; maps, diagrs., ills., index, bibliogr. American Book Co., New York, 1916. 72 cents and $1.24. 10 x 8.

The distinctive feature of these books is the emphasis placed upon industrial and mmercial geography. The amount of physical geography is wisely limited to that hich is necessary to explain geographic relationships. The subject-matter of the texts eets the demands of elementary school geography in that it accounts for the development of the leading occupations of the regions treated and also sufficiently emphasizes the asons for the dependence of one region upon another. Thus it leads the pupil to an nderstanding of man's relation to his environment, and also to an understanding of the uses underlying international relationships.

In the teaching of elementary geography special emphasis should be placed upon t character of the people inhabiting the region studied. These books recognize this pr ciple by devoting one or more paragraphs to the topic "People" before taking up t occupations of the region. This is a distinct advance over the method commonly follow viz., that of treating the subject "People" after all other topics have been taken u thus implying that a knowledge of the people is not essential to an understanding of t response which the people make to their environment.

Another good feature of the books is the thoroughness with which the geograp of the United States is treated. In Book II, of the 368 pages devoted to regioi geography, 210 pages are given to North America. What is equally important, ref ences are frequently made, in the treatment of foreign countries, to conditions in t United States or to commercial relations with the United States, a practice which ter to fix in mind the essential facts of the geography of the pupil's own country.

Too much can hardly be said in favor of the maps. Particularly desirable featu are the small number of names on each map, the distinct boundary lines, and the attr tive appearance of the map as a whole. Pupils should find the study of these maps pleasure.

The illustrations are numerous and remarkably well selected. Because of th superior quality and their arrangement in relation to the text they cannot fail to aro interest in the subject with which they are associated.

While the text is written in a simple and pleasing style, the books would be assu greater success in the school room had closer attention been given to the child's po of view, that is to say, had more frequent reference been made to matters which a of particular interest to children. The teaching of the subject would also have b facilitated by a closer interweaving of causes and effects. It is necessary to have relati ships brought out so plainly that the untrained teacher as well as the pupils cannot f to recognize their significance.

There is little in either book to guide teacher or pupil in the solution of geograp problems. If we are to train pupils so that they will make use of their geography af leaving school, problem-solving is too important a phase of the work to be overlook

On the whole the books are a welcome addition to our present list of texts and th cannot fail to receive the recognition to which their many merits entitle them.

L. O. Packard

Miller, F. T., and J. W. Davis. (1) **Geography by grades, Grade 4A: C of New York, with introductory studies of the earth.** 160 pp.; maps, diagrs., i (2) **Geography by grades, Grade 4B: The earth; the continents.** xii and 160 p maps, diagrs., ills. Hinds, Noble & Eldredge, New York, 1913. 8 x 6.

Morris, George. **Regional survey as a help in science teaching (A conf ence on regional surveys, IV).** *Geogr. Teacher,* No. 43, Vol. 8, 1915, Part 3, pp. 1 169.

Niver, H. B. **Elementary geography.** vii and 360 pp.; maps, diagrs., ills., ind bibliogr. Hinds, Noble, & Eldredge, New York, 1915. 75 cents. 10 x 8. [Among maps is one showing the chief transportation lines of the United States, with names of the railroad systems and steamship lines—a worth-while topic not usua included in this type of book.]

Redway, J. W., and Russell Hinman. (1) **Natural school geography.** (Seri The Natural Geographies.) xxviii and 158 pp.; maps, diagrs., ills. (2) **Natu introductory geography.** (Series: The Natural Geographies.) 146 pp.; ma diagrs., ills. (3) **Natural brief geography, one-book course.** xxii and 162 pp.; ma diagrs., ills. American Book Co., New York. 1907, 1913, 1914. $1.25, ——, 80 c 12½ x 10, 10½ x 8½, 11½ x 8½. [The physical maps in (1), by E. Y. Farquhar, a step in the right direction. However, the use of the same hypsometric color inter (limiting contours, 0, 1,000, 2,000, 4,000, and 6,000 feet) on the continental and sectional maps leads to lack of expression in the latter, especially in the lowland ar (see New England, p. 54). Both the physical and the political maps are too crowd with names. And why place the isotherms on the political rather than on the physi maps?]

Schäfer, W. **Die Stadt im geographischen Unterricht.** Diagrs. *Geo Anzeiger,* Vol. 16, 1915, No. 11, pp. 327-331; No. 12, pp. 368-373.

Tonning, P. C. **The status of geography in the public schools.** *Journ. of Geo* Vol. 14, 1915-16, No. 6, pp. 236-237.

Whitbeck, R. H. **Ideals and aims in elementary geography.** *Journ. of Geo* Vol. 14, 1915-16, No. 3, pp. 65-70.

THE
GEOGRAPHICAL REVIEW

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A PILGRIMAGE IN NORTHEASTERN AFRICA, WITH STUDIES OF DESERT CONDITIONS

By WILLIAM HERBERT HOBBS

It is a significant fact that the men who have profoundly modified the oundations of natural science, those whose writings mark on the long ourney the important stations at each of which new outlooks have been fforded, have with few exceptions traveled to distant regions where nature ould be studied in her widely varied aspects. Alexander von Humboldt nd Leopold von Buch, Wallace and Darwin and Huxley, Lyell and Dana: hese are names that come at once to mind. For the most part these great cientists antedated the modern period of intense specialization, with ever reater narrowing of the field of study; but there is no reason to doubt hat for the broader systematic phases of natural science, and for the earth ciences in particular, conditions have not greatly changed in this regard. he geographer or the geologist who would correctly interpret the earth's ast records must have himself observed nature in different latitudes and nder different conditions of climate.

In so far as their means permit them to do so, American students of eology and geography, in common with their non-scientific compatriots, re believed to avail themselves of opportunities for travel; though prob- bly less than formerly, when the lack of well-equipped graduate depart- nents in America led them to pursue their studies at European and espe- ially German universities. The large expense entailed by extended travel, nd its opportunities for general culture, will usually counsel an itinerary o planned as to combine professional with cultural studies. Without ccess to the necessary literature, which is often scattered and not readily ccessible, such an itinerary may not be easy to lay out; and a real need xists for collated information concerning scientific pilgrimages of this ature.

Our universities being so generally surrounded by country which is vell watered, there is a special need that students of geology and geography

should as early as possible become familiar with the widely different aspects which are presented by the arid regions. Of deserts easily accessible from Europe, Egypt and the Sudan have perhaps the most to offer, while affording in addition the opportunity to study the most ancient and wonderful of human monuments. It is therefore proposed here to outline a geological pilgrimage in this region, where the conditions of humid and arid climate meet with more sharply defined contacts than elsewhere upon our planet.

The many possible routes to Egypt from Europe represent varying degrees of comfort and interest, the quickest being that from Brindisi in southeastern Italy. This route, like those from Naples, permits the student to make interesting excursions into the famous volcanic districts of the Italian peninsula. The route to Egypt via Constantinople and the Piræus (Athens) offers in normal times such allurements in the opportunities for observing Oriental life and customs and for traversing the theater of action of great modern wars as perhaps to compensate for the somewhat greater expense. The return from Egypt may be made to advantage by a different route, the cheapest and not the least interesting being by so-called "intermediate" steamer of one of the British lines from India with ports of call at Port Said and Malta. The chief disadvantage of such a passage is that the boats seldom sail on scheduled dates, and one must be prepared for some delay. Malta, which is of itself exceptionally interesting and offers access by steamer to Tunis with its hinterland of desert, has a daily service by small steamer with Syracuse in Sicily, the trip being made in eight hours.[1]

The approach to Alexandria from the sea affords one of the most remarkable of physiographic contrasts. Out of the low green plain of the fertile delta rises the slim column of the Damietta light, and, as we approach nearer, the minarets of the mosques and the tall chimneys of factories come into view: but this picture of fruitful soil and of human occupation is joined in sharpest contrast with the barren yellow *hamada* of the Libyan Desert, which stretches away westward into the distance. With slightly varying aspects this contact of desert and fertile land is one which the traveler will have ever before him in Egypt, until by its very repetition he ceases to be surprised at it and comes to understand why the Nile is in Arabic *bahr*, "the river." Its waters alone give life, and, were the groaning irrigating devices, the *shâdûf* and *sâkyeh*, to cease working, the strips of land along the banks would soon revert to desert.

While in Cairo the student will not fail to visit the Museum of Geology on the Sharia Sheikh Rihan, where he will find in frames general and special geological maps of Egypt and in cases a collection of the characteristic rocks and fossils of the country. The type specimens of the gigantic tortoise *Testudo Ammonis* and the Oligocene rhinoceros *Arsinoï-*

[1] Steamship lines are likely to be profoundly modified as a result of the world war.

therium are to be found here and, further, an excellent collection to illustrate the processes of desert weathering and erosion. Across the Nile

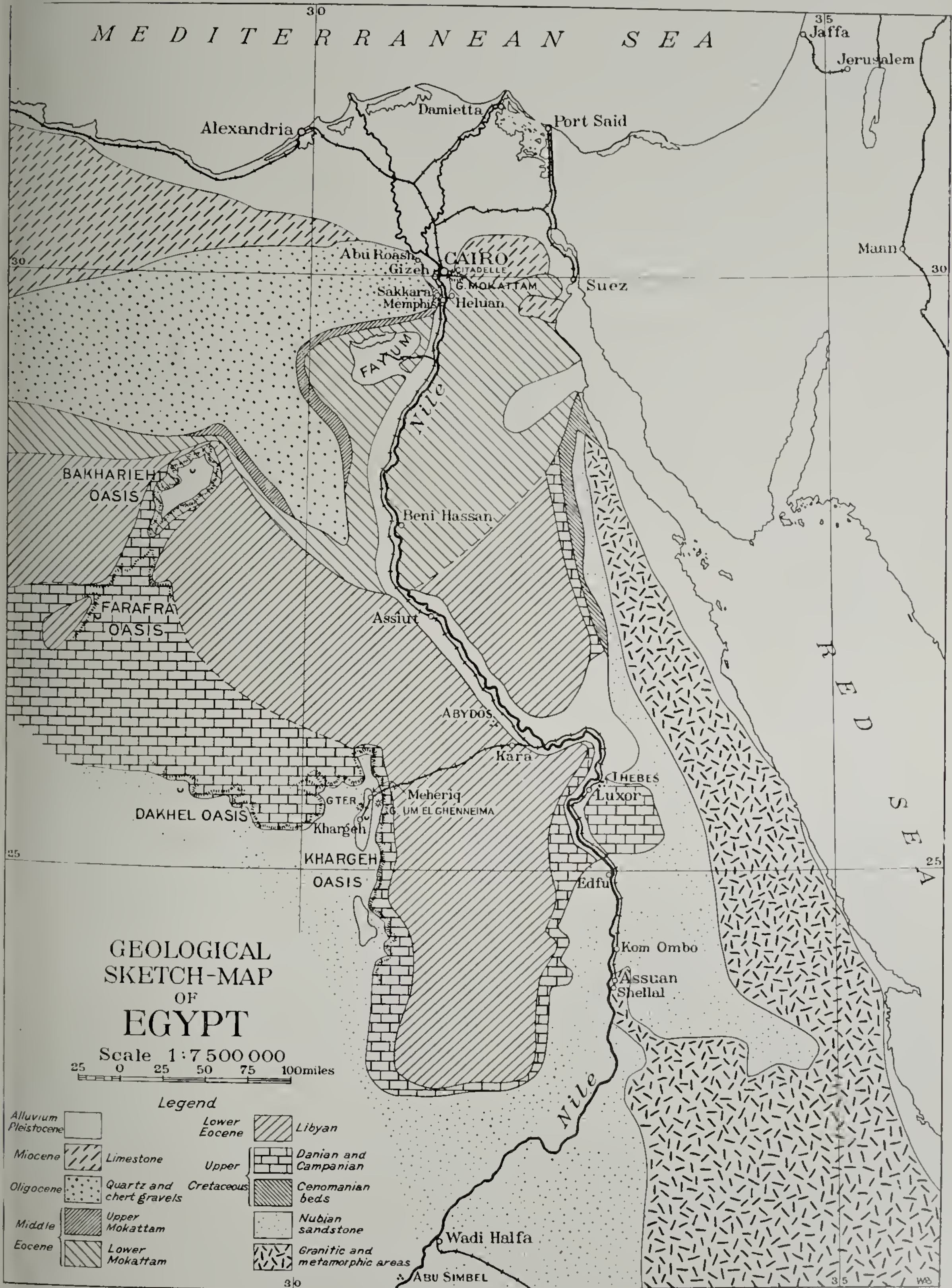

FIG. 1—Geographical sketch-map of Egypt. Scale 1:7,500,000. (After W. F. Hume: The Effects of Secular Oscillation in Egypt during the Cretaceous and Eocene Periods, *Quart. Journ. Geol. Soc. London*, Vol. 67, 1911, pp. 118-148.) The geological symbolism does not extend east of the Suez Canal.

in Gizeh are the attractive Zoölogical Gardens, with representatives of African animals, birds, and trees, the latter unfortunately seldom labeled,

so that one may really learn more of the Egyptian flora by a visit to the Ezbekîyeh, or public park, in the heart of Cairo.

A first bowing acquaintance with the Eastern, or Arabian, Desert may be made from Cairo, going by tram to the foot of the Citadelle and thence either on foot or by donkey past the Mosque of Mohammed Ali to the summit of the Mokattam Hill. This mesa-like hill is of nummulitic Eocene limestone and has supplied the name to the great limestone formation of Egypt which extends on both banks of the Nile to and beyond Luxor to be there replaced by the Nubian sandstone of Cretaceous age (Fig. 1). During the Pliocene or late Tertiary time the valley of the Nile was a fiord-like arm of the sea, as is shown by the *Clypeaster*-bearing deposits which are exposed near the west wall not far from Abadîyeh. The evidence of the subsequent elevation and its measure is indicated by the former shore-line on the Mokattam Hill, now at an elevation of about 200 feet above tide.

In visiting the Mokattam Hill one may continue his journey to the small petrified forest, where fragments of fossil wood, due to a silicification in Oligocene times, may be collected; but if possible the trip should be so timed as to view the sunset from the summit of Mokattam. Particularly after a strong wind, when the lower atmospheric layers are charged with the fine dust of the desert, the many hues of yellow and orange and red form a background to the range of pyramids which is not easily forgotten.

The great pyramids of Gizeh and the desert west and north of them as far as Abu Roâsh will repay at least two days of study, since here are opportunities rarely equaled to note the various phases of the desert weathering processes and sand polishing and to make observations stratigraphic and tectonic about the local uplift which in post-Mokattam time brought the faulted Cretaceous series into view in the core of the dome.[2]

Before outlining other excursions in Egypt it may be well to point out that the student who is a good walker and used to finding his own way with map and compass can well dispense with donkeys, donkey boys, and dragomans except on such longer excursions as are best made by camels. The Arab donkey boy in particular is found to have such limited knowledge of desert routes and such fear of undertaking a new one that he becomes a positive nuisance; and his patient little beast, unless cruelly beaten, is hardly able to make better time than the traveler afoot. Moreover, in the winter season the cool wind almost constantly blowing over the desert makes walking far from exhausting, though helmet and sun spectacles are necessary to shield one from the sun's rays. In this season, when alone the journey should be made, the heavy bottle of drinking water usually provided with luncheons may be dispensed with, for the

[2] H. J. L. Beadnell: The Cretaceous Region of Abu Roâsh near the Pyramids of Giza, *Geol. Surv. of Egypt Rept. for 1900*, Part II, Cairo, 1902.

fresh oranges or mandarins, which for a few piasters the traveler may purchase in sufficient number from the street vendors, will remove any sensation of thirst.

The necessary maps for excursions in Egypt can for the most part be obtained at the office of the Museum of Geology, Cairo, or at Diemer's book store in the Sharia Kamel, the valuable special maps by Schweinfurth and the geographic works treating of Egypt being obtainable at the latter place only. The topographic map sheets are published on two scales, namely, 1:50.000 and 1:10,000; and after laying out one's itinerary the necessary sheets should be procured at the museum office. They are, however, expensive and in most cases not indispensable. What the student cannot afford to do without is Professor Johannes Walther's "Das Gesetz der Wüstenbildung."[3] Not only is Professor Walther the "desert geologist" *par excellence,* and the new edition of his book the best treatment of what might be called the technique of travel of the geologist in arid lands, but its special adaptability to Egypt and the Anglo-Egyptian Sudan is shown by the fact that a majority of the localities cited for illustration and fully one-half of the 150 half-tone views which embellish the work are from photographs taken either in Egypt or in the Sudan.

Before leaving Cairo as a base, an excursion should be made to Heluan (35 minutes by train) and thence to the Walthertal, the Wadi Hof and neighboring Reilschlucht, and, if time permits, to the Wadi Gerraui and its ancient dam, in order to observe weathering effects in the hewn blocks.[4] In case the latter be omitted, the trip can be accomplished in one day, and it affords the opportunity to observe cliffs undercut through surface concentration and expansion of salts within the rock, combined with etching of the blown sand; likewise mushroom rocks, wadi location along fractures, the "blind" ends of wadis, etc. For this excursion Sheet II of the Schweinfurth series of maps[5] is indispensable unless one has Walther's book, in which a part is reproduced, since the newer government maps have abandoned the system of local names given by Professor Schweinfurth.

An excursion should also be made from the Great Pyramids of Gizeh upon the west bank of the Nile along the margin of the desert southward to Sakkâra and Memphis, the traveler returning to Cairo by evening train from the station of Bedrashein. The route will begin at the Mena House, where, if desired, donkey or camel can be procured. Here, as elsewhere in Egypt, it is best to bargain directly with a cameleer of the more responsible type, in order to avoid the commission which is secretly exacted by the hotel and is often as much as thirty to fifty per cent of the price. In passing the Great Pyramids the remarkable effects of weathering are to be noted low down within the range of action of the wind-blown sand, which

[3] Das Gesetz der Wüstenbildung in Gegenwart und Vorzeit, 2nd edit., Quelle & Meyer, Leipzig, 1912.

[4] Cf. Walther, *op. cit.*, pp. 23, 34, 117, 199, whence nomenclature.

[5] Aufnahmen in der östlichen Wüste von Aegypten, in 10 sheets, 1:200,000 (except Sheet 1, 1:30,000). Reimer, Berlin, 1897-1910.

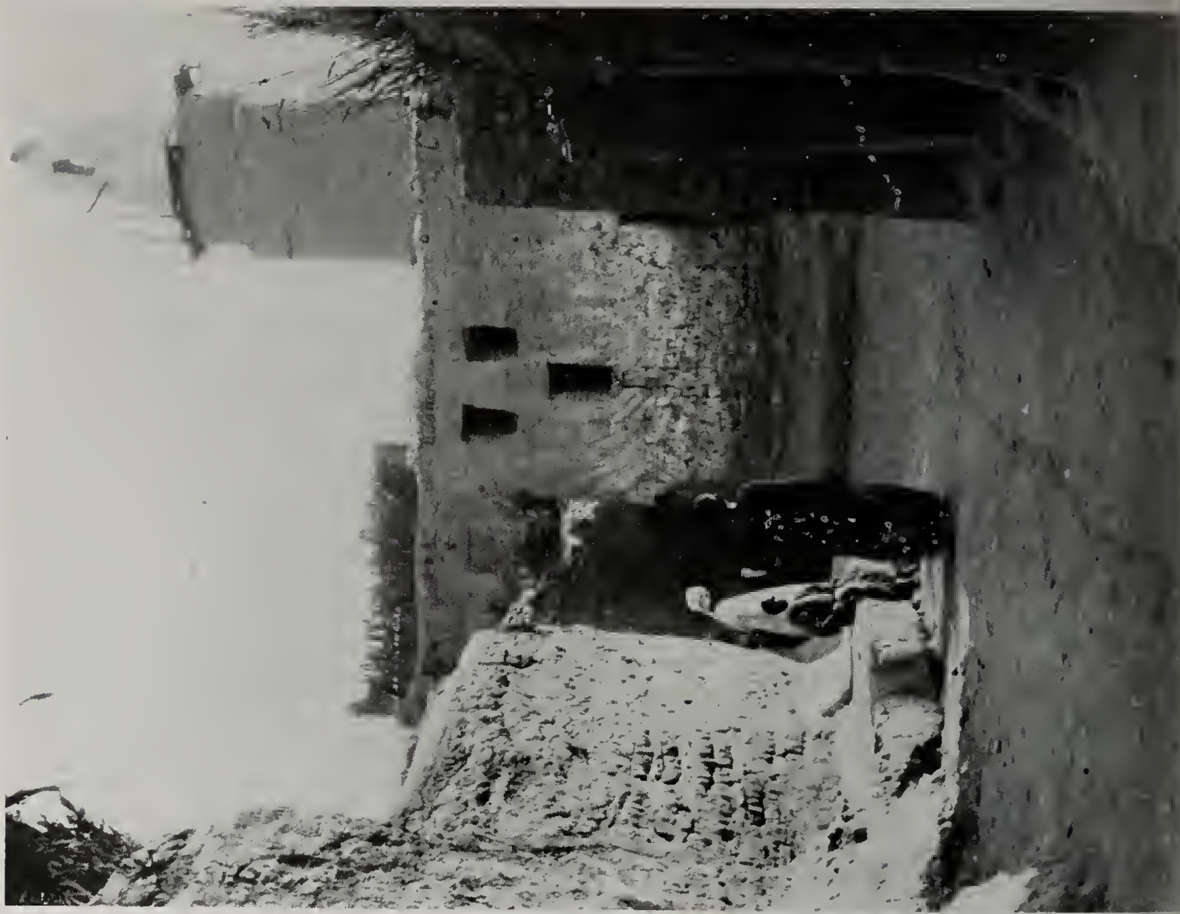

Fig. 4—Mule tram as means of conveyance on railway, Khargeh oasis.

Fig. 5—A Bedouin encampment in the Khargeh depression.

has here evidently been carried upward at various times in the past as result of dune accumulations about the base. The effects are most not worthy on the south and west of the middle, or Khefren, pyramid.[6] Th Sphinx brings into contrast the upper and lower divisions of the Mokatta limestone and exhibits well the manner in which softer layers yield t the attack of the blown sand.

Continuing along the desert margin we stop to observe the numerou flints, which here form an armor to the surface as a result of the liftin and removal of all finer materials by the wind—deflation. The residua flints remain entire in but few instances. Nearly all are split or sprun as a result of the temperature changes, which here have a wide range. Th main result, we are inclined to believe, should be charged to diffission, o splitting when the stone, highly heated in the sun, is splashed by the col dash of a desert downpour.

Arriving at the necropolis of Sakkâra the student of science will b amazed in contemplating the beautiful mural decorations in the *mastaba* of Ti and Ptahhotep, which prove beyond question that the Nile Valley in the ancient days when Memphis flourished, abounded in large and sma game—lion, antelope, oryx, ibex, gazelle—such as is found today in tha paradise of sportsmen far to the southward in the region of abundant rain With these African types there is occasionally seen the stag, a norther animal, and there are flocks of birds in great numbers. While the figure placed beside these animals and birds to indicate their numbers are with out doubt gross exaggerations (in one instance 121,200), the forme abundance of wild animal life in the Nile Valley must be admitted, sinc hunting scenes occupy so large a place in the reliefs.

By those who do not admit that important changes of climate hav occurred within historic time, the disappearance of the game fauna from the Nile Valley is ascribed either to a disease epidemic, such as the recen rinderpest in South Africa, or to unrestricted hunting, such as cause the practical extinction of the American bison. This is hardly the plac to marshal the evidence that great desiccation has actually occurred in th eastern Sahara within historic time, but rather to call attention to th necessity of a critical stage in the process of desiccation at which anima and vegetable life quite suddenly disappear. Such a crisis arrived in th Transvaal in 1913, and this has been vividly described by a lawyer wit keen powers of observation who resided at Rietfontein in the heart of th district.[7]

But it is the cities of the dead and not of the living which are in Egypt left for our inspection. Upon the site of ancient Memphis, where as nowhere else in the world geology and so-called recorded history come

[6] Cf. Walther, *op. cit.*, pp. 111-115.

[7] Eugène N. Marais; Notes on Some Effects of Extreme Drought in Waterberg, South Africa, *Ann. Rept. Smithsonian Inst., for 1914*, pp. 511-522 (reprinted from *Agric. Journ. of Union of So. Africa*, Feb. 1914.)

nto closest contact, we look down upon a chaos of ruined adobe walls. So trong was the belief of the ancient Egyptian in the immortality of his *ka*, r soul, and in the brevity of his life this side of the grave that it was nly for the future life of his spirit that he builded enduring monuments.

FIG. 6—The beautiful temple of Hibis, north of the village of Khargeh, in process of restoration: the nly building in Egypt which dates from the Persian dynasty.

t is none the less impressive to look down upon piles of débris which nclude the materials of a city of living inhabitants built at least 5,300 years go and we know not how much earlier.

It is in Cairo that the traveler will complete his plans for any longer ourneys up the Nile or out into the desert. The usual Nile tourist becomes

in most cases a hard-worked trailer in one of the conducted parties eith of Cook or of the Hamburg Anglo-American Company, and during a peri of three weeks or more he is hurried into caves of rock, where in numbe too large to permit of individual study of the monuments he is forced listen to unlearned dragomans who lecture in "pidgin English." If he h not by long preparation made himself a specialist in Egyptology, he likely to retain a confused impression only of the relationships of t many early kings and queens and of the gods and goddesses whose effigi are represented in such bewildering numbers.

The geological or geographical pilgrim, and we venture to say ma another, will wisely spare himself time and expense and add both to h knowledge and to his pleasure by keeping clear of the conducted parti and selecting only the more important monuments for his study. He ma thus, if he will, include in his itinerary the finest examples of Egypti monuments with a visit to Khargeh (Kharga) oasis in the Libyan Dese the "Great Oasis" of the ancients, and continue his journey far up t Nile and across the deserts to Khartum, returning by the Red Sea route Suez and Cairo, without greater expense in time and money than the co ventional tourist must undergo in his Nile journey to the first catara at Assuan.

A circular ticket to Khartum with return by way of Port Sudan an the Red Sea route should be purchased without the Cairo-Luxor coupo (for which liberal discount is allowed) and the journey begun by rail u the Nile, the traveler stopping at Beni-Hassan and Abydos while en route t Markaz esh-Sharikeh in Khargeh oasis.

No geologist or geographer can afford to miss the opportunity whic this side journey to Khargeh affords for becoming familiar with dese conditions. Probably nowhere within easy reach of civilization may s many phases of desert scenery be viewed from a car window and by cam journeys which do not require a camping outfit. It was in the hope o finding minerals and of developing the agriculture of Khargeh that th rich "Corporation of Western Egypt" built this railroad 122 miles i length across the *hamada* from the Nile to the oasis. After two and half millions of dollars had been spent in development, it was establishe beyond doubt that valuable minerals were wanting, and the exploitatio of the agricultural possibilities developed such difficulties that the projec ended in complete failure. Since the railroad has now been acquired b the Egyptian Government, it is likely that the scientist will long have th opportunity to utilize this field for desert studies, despite the disaster t the corporation. If dependence is had upon the trains, three days at leas must be devoted to the oasis, where an excellent rest house with all neces sary comforts has been established at the headquarters of the company i Markaz esh-Sharikeh, and where every courtesy is extended to travelers Before visiting the oasis the traveler should carefully read, and if possibl

ke with him, Dr. John Ball's "Kharga Oasis,"[8] H. J. L. Beadnell's "An gyptian Oasis,"[9] and Walther's above-cited "Das Gesetz der Wüsten-ldung."[10] As an antidote against the too strong *penchant* of both eadnell and Walther to minimize the evidences of recent climatic changes, e student is advised to read Ellsworth Huntington's "The Libyan Oasis Kharga,"[11] with its convenient sketch maps reprinted from Beadnell. he general map from Ball's report is sold separately by the Survey epartment of Egypt (Sheet D 4), but the railroad and newer develop-ents are not entered upon it.

The best train from Cairo reaches Oasis Junction (Mowaslet el-Khar-h) in the early evening. As at most other stations along the Nile there are re no accommodations for travelers, and word must be sent in advance telegraph to the station of Markaz esh-Sharikeh, so that a rail motor r may be in waiting at the station to take the traveler to Kara rest house the base of the *hamada* escarpment which forms the dividing line between e desert and the fertile plain of the Nile. If sufficient notice is given, is motor car can be used to carry a party of three or four across the tire 122 miles of desert plateau to the oasis, and the journey is thus ade in four (instead of six) hours, with the opportunity of stopping at teresting points to make photographs or examinations. This trip can so be made on any day of the week.

On leaving Kara the railroad at first skirts the edge of the alluvial ain of the Nile, then enters the mouth of the broad Wadi Samhûd with s steep rock walls and characteristic flat floor of flood-borne rock débris. s we ascend the walls approach, and one makes out in succession the veral beds of the Upper Cretaceous and Lower Tertiary formations which mpose the plateau. A bed filled with great melon-shaped flint concre-ons is easily identified and thus allows us to take note of the scores of nall vertical faults at fairly regular intervals with displacements measur-g in most cases a few feet only. Among them small flexures can also be ade out.

As the line ascends in zigzags we note the wadi vegetation along the or of the valley,[12] and as the level of each member of the rock series is ached in turn a new color tone characterizes the protective rinds of the sert stones. Once the plateau is reached the flat *hamada* surface stretches vay to the westward for nearly a hundred miles with no elevations in ght that rise more than a few feet above the general level. This true esa is capped by a dense limestone of Eocene age, which has been polished sand driven by northerly winds until it glistens in the sun like burnished

[8] Kharga Oasis: Its Topography and Geology, Survey Dept. of Egypt, Cairo, 1900.

[9] An Egyptian Oasis: An Account of the Oasis of Kharga in the Libyan Desert, With Special Reference Its History, Physical Geography, and Water Supply. John Murray, London, 1909.

[10] Note especially pp. 30-33, 54, 56, 79, 141, 151, 159, 161, 172, 185, 193, 208-209, 211, and 225.

[11] *Bull. Amer. Geogr. Soc.*, Vol. 42, 1910, pp. 641-661.

[12] For a study of this flora see D. T. MacDougal: The Deserts of Western Egypt, *Plant World*, Vol 16, 13, pp. 291-303.

ıetal. Wherever locally the surface of the ground is broken into low nobs the effective drilling portion of the sand streams has not been able) surmount them but has glazed the intervening trenches to the height f perhaps a yard, leaving the projecting tops as rough and brown reefs ongated in the wind direction. The parallel bands which stretch westard in considerable numbers on either side of the railway mark the posion of the ancient caravan trail across the *hamada,* the camels in caravans eing accustomed to maintain fairly uniform intervals in their ranks and follow with great fidelity the worn tracks of their predecessors.[13] The ose stones along the route are thus eventually kicked out of the trail, so ıat it becomes ever more distinctly marked.

Sometimes for many miles the route of the railway crosses areas within hich the ground is strewn with ellipsoidal flint concretions, these flints nerally averaging a foot or more in diameter, so that they present the ppearance of a field of watermelons; they are in fact referred to by the edouins as *el botik* (melons).

Near the railway station at kilometer 100 are several isolated sickleaped dunes, or *barkhans,* composed of yellow sand, which are connected ith others in a far-flung north-to-south train here intersected by the railay. From this part of the plateau mirages are generally visible at id-day far away to the north, where the greatest expanse of the plain is be viewed.

As one approaches the western rim of the plateau toward Khargeh sis low flat-topped hillocks interrupt the surface; these have become ıdermined by the etching sand blast to form the canopy rocks so charteristic of deserts (Walther's *Baldachinfelsen*). Between them occur stinct basins with alkali deposits.

In the immediate vicinity of the western rim the scenery changes as ough by magic and one looks out to the westward as far as the eye can ach over a deep pit excavated from the plateau. On the floor of the pit e eye makes out the dark flecks which indicate the position of oases 'ig. 4) and the yellow bands which represent areas of dune sand, while re and there rise on steep slopes the flat-topped outliers of the plateau. the train begins to descend into the depression by the Refûf Pass there is n to the north within the pass what from the distance appears not like a black lava stream, but which is in reality an elaborately terraced ıss of calcareous tufa. This tufa marks the position where, in a former riod characterized by a relatively humid climate, a stream of water ured off the plateau into the basin. Within the tufa are enclosed imessions of leaves, and among them those of the oak, which today is not be found within Egyptian territory and requires for its growth a atively humid climate.

[13] For a striking photograph of camel trails in the desert see Fig. 13, facing p. 487, of W. A. Cannon's cle in *Bull. Amer. Geogr. Soc.* Vol. 45, 1913.—Edit. Note.

Fig. 9.

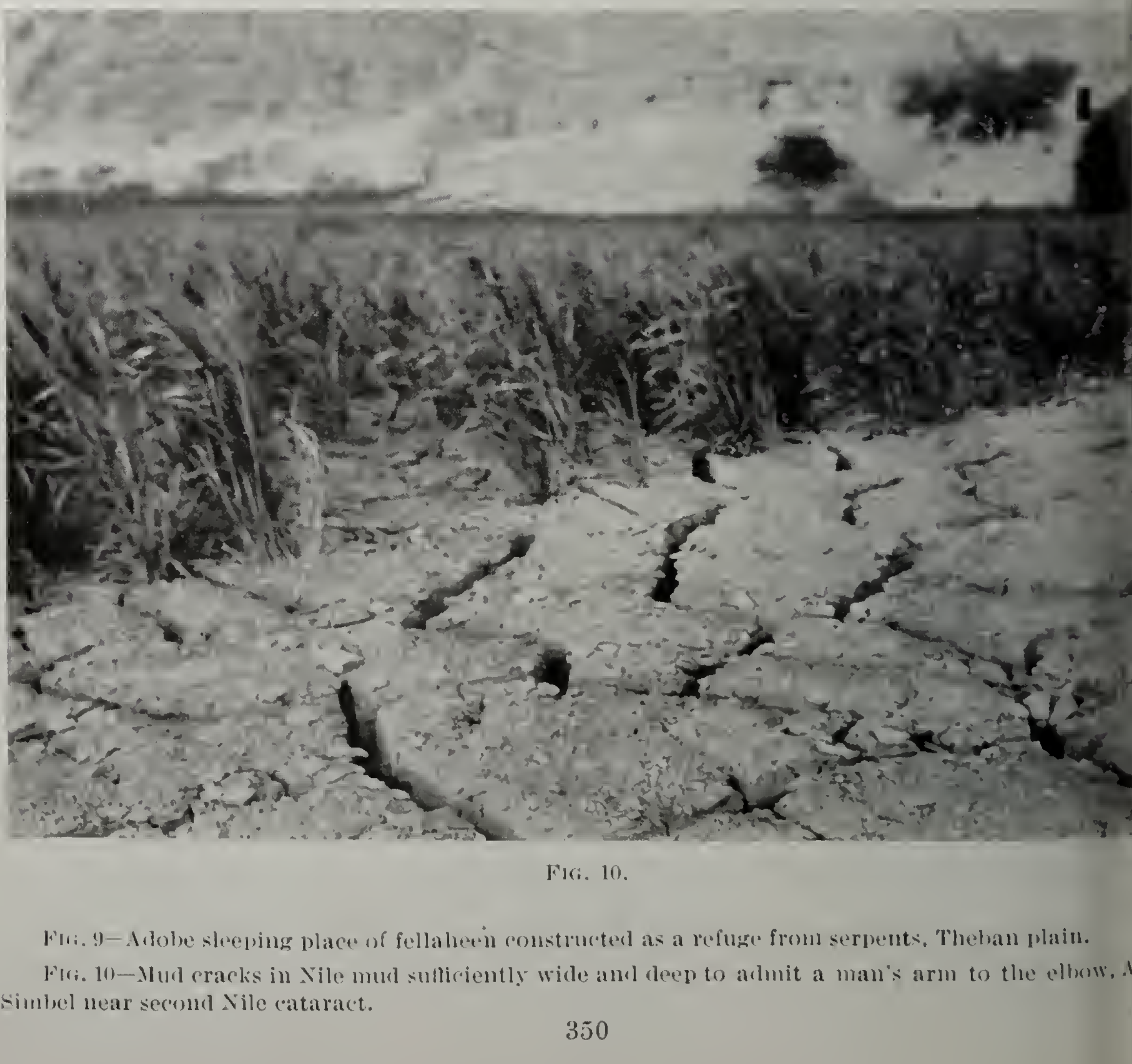

Fig. 10.

Fig. 9—Adobe sleeping place of fellaheen constructed as a refuge from serpents, Theban plain.

Fig. 10—Mud cracks in Nile mud sufficiently wide and deep to admit a man's arm to the elbow, A Simbel near second Nile cataract.

FIG. 11.

FIG. 12.

FIG. 11—Inundated villages with date groves caused by recent elevation of barrage at Assuan. eroidal weathering of granite seen on further shore, Nile above Assuan.

FIG. 12—Old landing place at Shellal above Assuan dam showing peculiar spheroidal weathering of iite under desert conditions. Submerged Berber village indicated by the crowns of palm trees rising of the Nile in the distance.

From the earliest times the oasis has been a place of exile, and tod the train deposits its chain gangs of "undesirables" guarded by bla Sudanese soldiers at the first oasis station of Meherîk. These "undesi ables" are in many cases common criminals, and since they would unable to escape from the depression unaided, they are not imprison and are often unfettered when at work. The village barber at Meherî with a record of seven murders, shaved his patrons while a Sudane soldier stood near at hand armed with a rifle.

As applied to any one of the several basins within the Liby *hamada,* the term oasis is clearly a misnomer, for far from being oas they are arid tracts that enclose small "islands" of waving palms th are the true oases. The water for these *ains* is brought to the surfa in part by natural springs but more largely by means of true artesi wells. These *ains* constitute less than one per cent of the surface at t bottom of the Khargeh depression. The deeper water-bearing lay found at a depth of several hundred feet beneath the floor of the bas appears to have been tapped in the very earliest times by pipes whi had been hollowed from acacia *(sont)* logs cleverly joined to one anoth Such constructions betray a high degree of intelligence, and the vario ruins would indicate that large and prosperous communities were esta lished in the basin near the beginning of the Christian era. Today t people are idle and in intelligence much inferior to the fellaheen of t Nile Valley. Few of them have sufficient enterprise to journey to t neighboring villages. It is possibly because of this lack of enterpris though probably more largely owing to the fact that the district has be shielded from tourists, that the idea of *bakshish* is almost unknown.

The principal village is Khargeh, which has a population of 4,500, an with 125 wells supports nearly 45,000 date and *dûm* palms, or nearl two-thirds the entire number growing in the basin. This village is bui largely underground as a protection against enemies and resembles a gre rabbit warren.[14] In a central square open to the sky there is a rathe picturesque mosque (Fig. 3). As one threads his way through the na row streets he catches glimpses of women untidy of person, but with gre gold rings inserted through the nose and wearing necklaces of the san precious metal. Basking in spots reached by the sun are young childre whose faces are so covered with flies as to appear like black patch except where the raw surface is exposed.

Like the palms, exotic products of the desert, alfalfa or lucerne grown and in repeated crops, sometimes as many as twelve in the yea with, in addition, beans, barley, summer wheat, cotton, and sugar can Of denizens of the desert there are the acacia *(sont)* trees, tamarisks, an camel grass.

[14] Cf. the account of the underground dwellings of the Matmatas, a Berber tribe living in the Tunisi Sahara, and Figs. 8, 9, and 10 of J. Russell Smith: The Desert's Edge, *Bull. Amer. Geogr. Soc.* Vol. 47, 191 pp. 813-831.—Edit. Note.

Few areas realize the conditions of absolute aridity more perfectly than this basin of the desert, in which the moisture of the air is only about one-fourth of that in Cairo, and where the skin cracks and finger nails quickly become brittle. For a period of at least twelve years no rain has fallen in the inhabited portion of the depression. There is, none the less, abundant evidence that in earlier times the region was more favored by climate and supported a large population. Mention has already been made of the heavy deposits of calcareous tufa which extend for several kilometers downward from the head of the Wadi Refûf on the line of the railway, and that leaves of the oak are encased in these deposits. This can only indicate the course of a stream which fell over the brink of the plateau as a cataract. Somewhat similar deposits have been found at the edge of the plateau above the Nile Valley. Probably dating from the same humid period are extensive lake deposits deeply cut by wind erosion which occupy the valley bottom over considerable areas near Markaz esh-Sharikeh and Khargeh. Fragments of pottery and complete utensils which have been exhumed from these lacustrine beds would indicate that the body of water, which at one time reached the level of some 275 feet above the sea, continued well into the historic period, if not into Græco-Roman times.

In order to reach points in the basin along the line of the railway, the traveler may make use of a mule tram to carry his supplies while he makes excursions afield in various directions (Fig. 4).

The beautiful temple of Hibis is situated four kilometers north of the village of Khargeh and is the only building in Egypt dating from the Persian dynasty (521-338 B. C.). Built by Darius the Great and largely buried in sand, this temple has been recently exhumed and restored under the auspices of the Metropolitan Museum of New York, with the co-operation of other societies, aided by the active personal interest of the late Pierpont Morgan. Small though this temple is and half hidden in a grove of date palms, its beauty is such as to call forth the admiration of every lover of art (Fig. 6).

At the unique Christian necropolis, a city of some two hundred tombs laid out regularly in streets (Fig. 8), one gains as nowhere else in the region a conception of the importance, relatively to the present, of the former life of the region. Here as elsewhere in Egypt one is struck by the fact that though we have before us the cities of the dead bespeaking a people of wealth and power, we nowhere find more than a trace of their earthly habitations.

The necropolis gives but a partial idea of the extent of earlier habitations, though it undoubtedly indicates better than anything else the prosperous condition of the inhabitants. Today in Egypt and the Sudan the burial of a man of the people is made as simple as possible. The body is carried out of the village, deposited upon the ground, and a few handfuls

of sand are scooped over it. Thus exposed, the kites and other scavengers soon remove the fleshy portions, leaving the skeleton only. The country is one in which customs have persisted with little change throughout the ages, as perhaps nowhere else upon the globe, and inasmuch as the embalming process involves the use of expensive materials this mode of burial has been restricted to the more prosperous. None the less there are found in other portions of the Khargeh depression simple rock tombs, and in one instance these have been ravaged by mummy thieves in order to secure jewels and other trinkets left upon the bodies. With their wrappings removed the bodies were left scattered over the surface of the desert presenting the appearance of a small battlefield (Fig. 7).

Aside from questions relating to human occupation, the depression of Khargeh supplies type illustrations of purely desert features, such as armored pebble pavements and canopy rocks, and in addition more unusual features which are dependent upon the nearly constant direction of the wind. Elongated ridges rising abruptly to windward and sloping gradually away to leeward have been carved out of the lake deposits near Markaz esh-Sharikeh. Few, if indeed any, regions offer such advantages for solution of the problem of origin of desert depressions, but the subject must be treated in another place. Before leaving the Khargeh oasis to return across the plateau to the Nile Valley the traveler should make one or more journeys by camel, the most interesting being perhaps that to the old fortress of Ed-Deir so as to pass on the way the butte of Gebel Um el Ghenneima. En route there is opportunity to study sickle-shaped dunes, or *barkhans,* the records of great desert cloudbursts of extremely local extent in deltas of torrential deposits, and, in the notch of the butte, remarkable examples of hoodoo-like spines cut out of limestone containing the hard shells of *Operculina Libyca.* Another trip should be made to the summit of Gebel Ter, where an excellent section of sedimentary formations with their enclosed fossils may be examined.

After returning to the Nile Valley the traveler may continue by rail to Luxor in the Theban plain, where are the remarkable tombs and temples, and from whence either by steamer or by rail the journey may be continued to the First Cataract, with stops at Edfu and Kôm Ombo. It is at Assuan, the ancient Syene, just below the cataract, that the granite first makes its appearance overlain by the Nubian sandstone. The great quarries at this place supplied the builders and sculptors of ancient Egypt, and their half-finished work remains for our inspection when we visit the quarries. Opposite Assuan is the granite island of Elephantine, with its interesting pot holes, which were made the subject of an important study by Professor Jean Brunhes.[15] The granite of this district, after extensive erosion, was overlain by the Nubian sandstone, and the channels within the granite which are followed by the river are marked out either as lines

[15] Le travail des eaux courantes, *Mém. Soc. Fribourgeoise des Sci. Nat.*, 1902, pp. 153-224.

f faulting or as zones of closely spaced dikes composed of more basic gneous rock, such as basalt.[16]

If the desert route to the Nile dam or barrage at Shellal be taken, one 'ollows for a large part of the way the right bank of the cataract, with bundant opportunity to observe the blackened crust or rinds formed upon he surface of the granite within the range of the inundations. These rinds ave been found to consist chiefly of manganese dioxide together with erric oxide, lime, silica, magnesia, and traces of other substances.[17]

The effect of the latest addition to the barrage has been to raise the evel of the water impounded above it by some five meters, submerging nany villages whose position is indicated today by the crowns of date palms rojecting above the water (Figs. 11 and 12). The characteristic weathering forms of the granite are spheroidal blocks regularly piled together. For days the half-submerged palm groves and these weathered masses give character to the landscapes viewed from the steamer en route to Wadi Halfa. At Abu Simbel, forty miles below Halfa, is the rock temple which is perhaps the finest of all the monuments of ancient Egypt. From Halfa the journey is continued by *train de luxe* across the sand desert o Khartum and thence eastward to the Red Sea at Port Sudan, the newly reated harbor near Suakin. This portion of the journey is so well covered y Walther in his "Das Gesetz der Wüstenbildung"[18] that it is unnecessary o treat the subject here. The traveler returns from Port Sudan by way of he Red Sea to Suez and Cairo, thus completing a circular tour.

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[16] John Ball: A Description of the First or Aswan Cataract of the Nile, Survey Dept. of Egypt, Cairo, 1907.

[17] A. Lucas: The Blackened Rocks of the Nile Cataracts, Survey Dept. of Egypt, Cairo, 1905.

[18] Especially pp. 66, 72-75, 107-109, 153, 244, 285.

THE LAND OF THE MAQUIRITARES*

By LEO E. MILLER

Despite the great heat of the tropical lowland, the sight of the wine red river hurrying silently past on some mysterious mission of its own was enough to chill the blood with an uncanny sense of dread and foreboding. Each foam-flecked wave, each racing whirlpool, the water itself, stained an ominous red, spelled treachery and a frenzied desire to engulf everything within its grasp. A wild mantle of low, gloomy jungle invested both banks far as the eye could see. Such was the Rio Atabapo when we saw it, a short distance above the point where it merges its terrifying character with that of the mighty Orinoco.

For the present, however, there was nothing to fear. The water tore at the granite battlement, against which our craft had been securely tied with impotent fury. Above, forlorn and deserted, stood the fifty-odd adobe huts of San Fernando de Atabapo, almost the entire population having gone up-river to the scattered rubber camps, as this was the season for collecting the valuable latex. This last settlement in the Orinoco country was indeed a town in name only.

From the top of the granite eminence, the elevation of which is only 370 feet above sea-level, we could look across the broad sweep of the Atabapo and up the muddy Guaviare, coming from the southwest, which joins it on the side opposite the settlement. The mean temperature of the region is about 80° F., although in the sun the mercury ascends to 112° F. or more, but the town is not particularly unhealthful. There are few fish, no crocodiles or sandflies, and practically no mosquitoes, all of which is attributed to the discolored water. Two small springs near the town furnish an abundant supply of potable water, and, when during the rainy season these are covered with the overflow from the river, it is necessary to paddle across the Atabapo and fill the water jars from the Guaviare.

To secure a crew of men for our trip up the river was a difficult undertaking and required a great deal of time. This gave us an opportunity to explore the surrounding country.

In the immediate vicinity of San Fernando the forest has been cut down and tall second-growth sprouts form dense thickets; this is the favorite resort of many small birds, and several species of nighthawks make it a daytime rendezvous. The basic granite crops out in many places, the

* This is the second of two articles dealing with the author's zoölogical reconnaissance trip in 1912-13 up the Orinoco to the Mount Duida region in southern Venezuela. The first article, published in the April *Review*, pp. 258-277, carried the expedition as far as San Fernando de Atabapo. The present article takes up the narrative at that point. For location of places see the map in the first article.

ledges occasionally standing on end, and it is often streaked with narrow seams of quartz. There is no cultivation of any kind; the inhabitants lack all initiative for work and eat tinned foods and manioc received in exchange for trinkets from the Indians.

When we returned a few months later, a changed town confronted us. The rubber collectors had returned from their several months' isolation in the interior and were spending the fruits of their labor as rapidly as possible. Dance halls, gaming dens, and almost every conceivable device for relieving men of their money had sprung up like mushrooms, and there was drinking and merry-making day and night. Then suddenly and without presage a tragedy occurred; it will never be forgotten by the few who survived.

Governor Pulido, so it was rumored, had imposed a new tax on all rubber collected in the district and had come to San Fernando personally to collect the extortion. Naturally, there was a good deal of dissatisfaction, and one night, just after we had been provided with a canoe and secretly advised to leave as soon as possible, the storm broke. A band of men, said to be under the leadership of one Colonel Funes, an Indian and the most notorious man in the district, attacked the town, killed the governor and practically the entire male population, and rifled the shops and dwellings. If one may believe the tales of the few who escaped the brutalities committed that night, the deeds rival those of the most barbaric ages.

Perhaps some of those who perished deserved their fate; others assuredly did not; but it is a fact that government offices had been conducted abominably. In the post-office, for example, stamps were sold for twice their face value, and if one did not purchase them there and place them on the letters in full view of the postmaster, the mail was destroyed. The physician who chanced to be there, named La Page, and who apparently belonged to the military organization, as he wore the regulation uniform, tried to collect over four hundred dollars, gold, for a few injections of quinine; and so the robbery went on until the whole band was exterminated.

Having engaged a captain with some experience on the upper Orinoco and a crew, we on February 3 loaded the low river-boat and started on our mission, reaching a point called Puerto Ti Ti that night; from this spot a wide trail leads through the magnificent forest to the clearing wherein stands San Fernando.

For six days we made slow but steady progress up the river and then entered the formidable Raudal de Santa Barbara, a rapid which extends across the entire delta of the Ventuari.

The Orinoco here is wide and, with few exceptions, so shallow that we pushed ahead with long poles. Where the water was deep and the current swift, long-handled hooks were used to catch the overhanging vegetation and pull the boat along. This mode of travel was always slow and

FIG. 2—Raudal del Muerto on the Cunucunuma: unloading the *piragua* preparatory for the portage.

dangerous, and the swarms of wasps and other insects living among th leaves, which were shaken down by this procedure, made far from agreeabl traveling companions. The banks were covered with dense, virgin forest but there were extensive sandbanks and flat ledges of rock at convenien intervals, and one of these was always chosen for a night's camping sit If we chanced to be on a *playa,* the early hours of the evening were spen in fishing. Armed with *machetes,* a bag, and acetylene lamps, we wade out in the shallow water and "shined" the shoals of fish much in th manner that frogs are caught in parts of this country. At night the fis swam near the surface, and by directing the rays of the strong white ligh upon them one could approach to within a short distance and then strik with the knife: in this manner large numbers were taken. Occasionall a large sting-ray, electric eel, or crocodile was suddenly encountered, an then there ensued a hurried scramble in the other direction; this gav the pastime a decided element of sport. We also became more familia with the dreaded *carribe,* or cannibal fish, known as the *piranha* in Brazil with which the water teemed. In the Orinoco they attain a weight exceed ing three pounds and are formidable indeed. The natives will not go i bathing except in very shallow water, and I know of two instances wher men were attacked and severely bitten before they could escape. The fis somewhat resembles a bass in shape, although the mouth is smaller; th jaws are armed with triangular, razor-edged teeth, and as these fish travel i immense shoals they are capable of easily devouring a man or large anima if they catch him in deep water. Floundering or splashing in the wate attracts them, but they seldom attack unless their appetite has been whette by a taste of blood, and then woe to the unfortunate creature that falls int their power. To catch them, we used a strong hook secured to a long wir leader and baited with any kind of raw meat, and they always put up a good fight. Without a wire, a line would be bitten in two every time a fish struck. When taken from the water they are first killed by a blow on the head with the *machete* and then removed from the hook.

At night there was always a heavy dew, and it rained intermittently each day. On dark nights, and often after a shower, the banks of the river, where there was forest, glowed with twinkling phosphorescence. Examination showed that the decaying vegetation was filled with myriads of small, wriggling insects, greatly resembling our well-known cellar-bug (isopod), and one day we paddled for many hours through a mass of flying ants which had come to grief in the river. The water was covered with them, and the waves had tossed them up on the banks to a depth of several inches. Another thing that attracted our attention was the large number of bats. On one occasion we heard a dull rumbling among the granite ledges near camp, and, not long after, a stream of bats began to emerge from the cracks; from a distance they resembled a cloud of smoke. There must have been many thousands, for the black masses continued to rise

ntil darkness obscured them from our view. Spruce[1] records that on ne occasion he saw not less than a million under similar circumstances. 'his brings up an interesting problem; the individual range of these bats s probably not very great, the result of which is that immense numbers f them are distributed over a comparatively small area. Now, if the truggle for existence is as keen as it is often supposed, how can the female, ncumbered with her offspring fully three-fourths as large as herself, comete successfully with the unhampered males and secure enough food not nly for herself but also for her young? The fruit-eating varieties might ot suffer seriously from this handicap, but it does seem as if the agility f the insectivorous kinds catching their food on the wing would be greatly ffected.

There are numerous geological features along the river which cannot 'ail to attract the interest of the traveler, no matter what his particular nission may be. One of these is the Cerro Yapacana, a square block of granite not over 6,500 feet high, an outlier of the Guiana highlands, that nass of ancient rocks which extends across eastern Venezuela and the Guianas and along whose base the Orinoco describes its semi-circular ourse. It is a very conspicuous landmark, as it towers above the forest ike a giant monolith and can be seen many miles away. We did not come breast of it until eight days after first sighting it.

There are few rubber camps along this part of the river, but several Indian families had come to spend a number of weeks collecting turtles and eggs on the sandbanks. At night absolute quiet reigned on the *playas* so long as the moon shone; but no sooner had the brilliant orb disappeared below the horizon than the water was broken into ripples as numbers of turtles emerged to deposit their eggs in the loose, warm sand; and jaguars came from the dark forest to feast on the defenseless creatures and rend the still night air with ugly coughs and grunts.

In returning from fishing excursions we usually cut across the several miles of sandy waste toward camp, guided by the bright fire which the cook was required to keep burning, and in this way learned a good deal about the turtle's habits. After leaving the water, the creature makes its way toward the highest point on the island or *playa*, and with a few powerful strokes of the flippers excavates a deep hole; the eggs, twenty to a hundred in number, are then deposited, after which the sand is scooped back into place and patted down so carefully that it takes a very experienced eye to locate the spot. The turtle then hurries back to the water, where it apparently remains until the following year. When the eggs, warmed by the sun's rays, finally hatch, the *playas* swarm with small turtles, which are eagerly collected by the natives, cooked entire, and eaten. The egg contains a great deal of oil and, although boiled a long time,

[1] Notes of a Botanist on the Amazon and Andes . . . . , 1849-64, edit. by A. R. Wallace, London, 1908.

lways remains soft. *Iguana* eggs are taken also and boiled and eaten even vhen about to hatch.

Besides the turtles there were many other signs of life on the sand-anks. Waterbirds, squatting low in some cup-shaped hollow, looked tupidly at the dazzling light of the gas lamps and could be approached o within a few feet; downy young birds waited quietly until nearly touched vith the hand and then ran away into the darkness like puff-balls rolling efore a breeze.

The Raudal de Santa Barbara is a wicked stretch of water. The Ven-uari, coming from the neighborhood of the Brazilian border, forms an xtensive delta at its mouth. There are many islands, some of great size, nd all heavily forested. The Orinoco is very wide, and hundreds of sharp, all rocks protrude above the water, causing a series of rapids which are ıard to ascend. It took us three days of the most trying kind of work o traverse this stretch of agitated water and finally to haul the boat up he falls, which come as a sort of climax at the end. A strong wind blows 'rom the north almost constantly, whipping the water into a choppy sea.)n the bank stands a good-sized rubber camp, and extra hands can usually e secured to help pull the boat through the rapids. The men from this lace had just returned from a hunt in the forest, bringing two jaguars nd an armadillo weighing sixty-five pounds. One of the jaguars was lack. All of these animals were eaten, and of the two species the flesh f the jaguars was the better. One night, not long after, one of these nimals invaded our camp. As the sandbank we had selected was a nar-ow one, the crew chose to sleep on the forest side; they greatly feared he crocodiles in the river. Early in the morning I was awakened by a aguar's roaring, mingled with frightened wails, and upon investigation liscovered that the men had come to our part of the camp near the water, eaving the captain's wife in their former location. They had reasoned hat she was the least useful member of the party and had compelled her o remain as "bait." Maria was sent back to San Fernando in the next anoe we met bound down the river.

The abundance of the big, spotted cats and their harmlessness under ordinary circumstances is astonishing, although at times they will attack uman beings. At one of the rubber camps we were shown the skin of a ecently killed animal which had stalked a two-year old child at play not ar from the hut; the mother, a negress, seeing the animal in time, attacked t with a *machete* and killed it.

The next river of any importance to be encountered was the Rio Lao, eached on February 17. Up to this time the strong north wind had con-inued to blow without interruption, and the course of the river was strewn vith islands. Rubber camps dot the river bank; and we had our first glimpses of the Maquiritare Indians. Owing to the frequent rains, the year had been a bad one for the *patrones,* or managers of the camps; also,

a kind of malady had broken out among the peons and Indians which kill many and frightened others away. Nevertheless, those who remain seemed quite contented, and, if we chanced to spend the night at a cam or *barraca,* our men always joined them in their pastime of drinking, pla ing the guitar, and singing songs about one another far into the nigl Some of the men were clever at improvising songs apropos of the occasio At one place, for instance, they heard of the jaguar's visit to the sandba and that the captain's wife had been sent back to San Fernando. Witho hesitation, one of the peons sang:

Que tristeza en nuestro campamento!
Pobrecito Ildefonso está llorando.
A caramba, nadie está alegre!
Será porqué Maria fué á San Fernando.

The largest *barraca,* by far, which we saw was owned by an old Tu named Parraquete. He received us cordially, shook our hands, and en braced us, apologetically explaining that a slight fever prevented his risin from the hammock; later we found out that he was a leper in the last stag of the disease. He had fifteen Maquiritares in his employ, each of who collected the latex from several hundred rubber trees every morning; the afternoon the milk was smoked, one hundred pounds of the liquid yiel ing about forty or fifty pounds of crude rubber. A kind of heavy, de red wood called *mazarandul* was used to produce the dense smoke nece sary to coagulate the latex. *Hevea* only was gathered here, although *bala* was also collected farther down the river and on the Guaviare. The gove nor of the district told me that about fifteen million trees of the *bala* had been cut down along the latter river during the last ten years, as th method of securing this class of rubber necessitates the felling of the tre

The proprietors of the rubber camps use the same system of keepin their helpers that the purchasers at Ciudad Bolivar employ; namely, the keep them constantly in debt by advancing large quantities of mercha dise at exorbitant prices. It is not unusual for one *patrón* to sell some o his men to another for the amount of their debt, or more, if he can get i and sometimes an unsatisfactory peon is turned loose in the wildernes to shift for himself. We picked up one such man who had been abandone on a sandbank, in a half-starved condition.

Proceeding farther up the river, we passed the Cerro Cariche, anothe granite mass similar to Yapacana, but not quite so high. It stands on th south bank of the river, between the mouths of the two small streams calle Cariche and Trocoapure.

Early on February 21 we had the first distinct view of the Cerro Duida looming, faintly outlined, in the distance. From afar it resembled a high level plain; but as the vapor clinging to the huge, dark mass slowly dis solved itself a well-defined, short range appeared, with twin peaks showin high above the rest of the mountain.

Fig. 5—Wild cane along the bank of a tropical river. The paths have been made by wild animals

The Orinoco steadily decreases in width, until the distance across i
not more than half a mile; in many places the banks are high and co-
posed of pink and white clay streaked with layers of dark blue. On bo
sides the jungle presents an unbroken wall of tangled verdure; occ
sionally a slender palm rears its delicate head high above the riotous ma
as if gasping for one more breath of air before being strangled by the fi
and creepers slowly entwining its stem with their death-dealing tentacl
Among the lower growth are vast areas of palms known as *coco del mor*,
with long fronds resembling those of the *Seaforthia*, and bearing small, ha
nuts; the leaves are used in thatching huts and the *caroso*, or covering,
the boats. Another palm, tall and thorny, resembles the well-known *chon*
of Colombia; it bears large clusters of red nuts which are very palatab
when thoroughly boiled.

The heat was always intense and most oppressive; even the cool nigh
brought no respite, and in the early morning a thick vapor slowly ro
from the water, to be later wafted above the tree-tops and disappear.

Flocks of *hoatzins*, or lizard-birds *(Opisthocomus cristatus)*, were se
almost daily. They fussed and fluttered among the dense vegetation b
could not be induced to leave their dark retreat. There were also nesti
trees of the black and yellow orioles, better known as *cassiques*, which a
about the size of a bluejay; sometimes a single tree contained thirty
more nests placed close together; invariably there were also a number
large wasp nests in the same tree. The nests of these birds differed fro
those of the giant orioles *(Ostinops)* in being smaller and having the ope
ing at the top instead of at the side of the swinging bag.

At the end of the twentieth day we reached the mouth of the Cun
cunuma and camped upon its sandy banks for the night. This river
approximately 500 feet wide at its mouth, shallow, with dark, clear wat
and flows southward, joining the Orinoco at right angles, as the cour
of the latter river at this point is westward: a low, forested hill call
Ventana rises to the north. One may cover the distance from the mou
of the Cunucunuma to the Cassiquiare in a day, and reach the plains
which was located Esmeralda by continuing the journey an additional da

Not far above the mouth of the river is the dry bed of a stream, sa
to have been the former course of the Cunucunuma; short, soft grass no
covers the ancient, sandy route, and the lines of trees on each side prese
such clean-cut edges as to suggest well-kept hedge-rows. Tapirs an
capybaras have worn many paths through the luxuriant sward; apparent
these animals come out into the open at night to feed.

The current of the river is so strong that we could not average mo
than four or five miles a day. Through the clear water we could see shoa
of fish and numbers of large sting-rays darting about over the botto
One fish, resembling a beautifully spotted trout, rose eagerly to a traili
hook baited with a strip of white cloth; it weighs about a pound and

alled *pabón* by the natives; on two occasions members of this species leaped lear of the water and into the boat as we poled along after nightfall. another kind greatly resembled a flying fish; leaving the water singly or ı pairs, it skimmed over the surface for a distance of twenty yards or nore, and then dropped with a splash; when "flying" it left a train of ipples in its wake, as if long appendages were trailing after it.

There now followed a series of low, disconnected mountains which night be called the foothills of Duida. The first of these is the Cerro 'iapoco, 1,300 feet high; parts of it are covered with low, scrub growth, nd the river winds around three sides of it. Next comes the Cerro Tapi-.ire, a rounded granite mass approximately 1,400 feet high. At the base f the latter is a large Maquiritare plantation of yuca *(Manihot Aipi)*, ineapples, and plantains, on the edge of which stood the communal house, onical in shape and 100 feet in diameter. The place was temporarily eserted, as the Indians were down-river gathering the rubber harvest. ear by also grew a palm new to us, the *tamiche;* it is thirty feet high, ith erect, undivided leaves, and the crown resembles a huge, green, open-ig tulip.

While tramping in the forest across the river from the Indian planta-on we came suddenly upon a Maquiritare woman and her four little chil-ren, squatting around a small fire built under a rough lean-to. She was oasting a curassow and tearing off pieces for her young brood, who were evouring them with the voracity of wolves. The frightened glances of nese wild people and their gnawing at the half-cooked flesh were quite in eping with their surroundings and stamped them immediately as a per-ect part of the virgin wilderness.

Rapids are not wanting in the Cunucunuma. The first is the Raudal el Muerto, formed by a wide ledge of rock which extends across the river nd over which the water rushes with a deafening roar. Next comes the andal del Sina, which is longer but not so difficult to navigate. Just bove this we entered the Sina, a small stream coming from the direction f Duida, and ascended to its highest navigable point; this, however, was nly a few miles above its mouth.

The Cunucunuma, it may be stated, rises in the vicinity of the little-nown Cerro Cauchamacari, and may be ascended to the foot of the Cerro aravaca. On some maps its course has been traced on the eastern side Duida, while in reality it is on the western side. Its tributaries from e east are the Tabarí, Sina, Cua, and Rio Negro; and from the west the acaré and Cumichi. There are numerous rapids. Besides the two men-oned, the Indians described the San Ramón, Rayado, Cháchcrito, Vaquiro, apaco, Chipirima, Picure, and Culebra, all of which must be passed fore reaching the Maravaca.

The scenery along the Cunucunuma is the wildest imaginable and celled in splendor anything I had heretofore seen. There nature, unre-

FIG. 6.

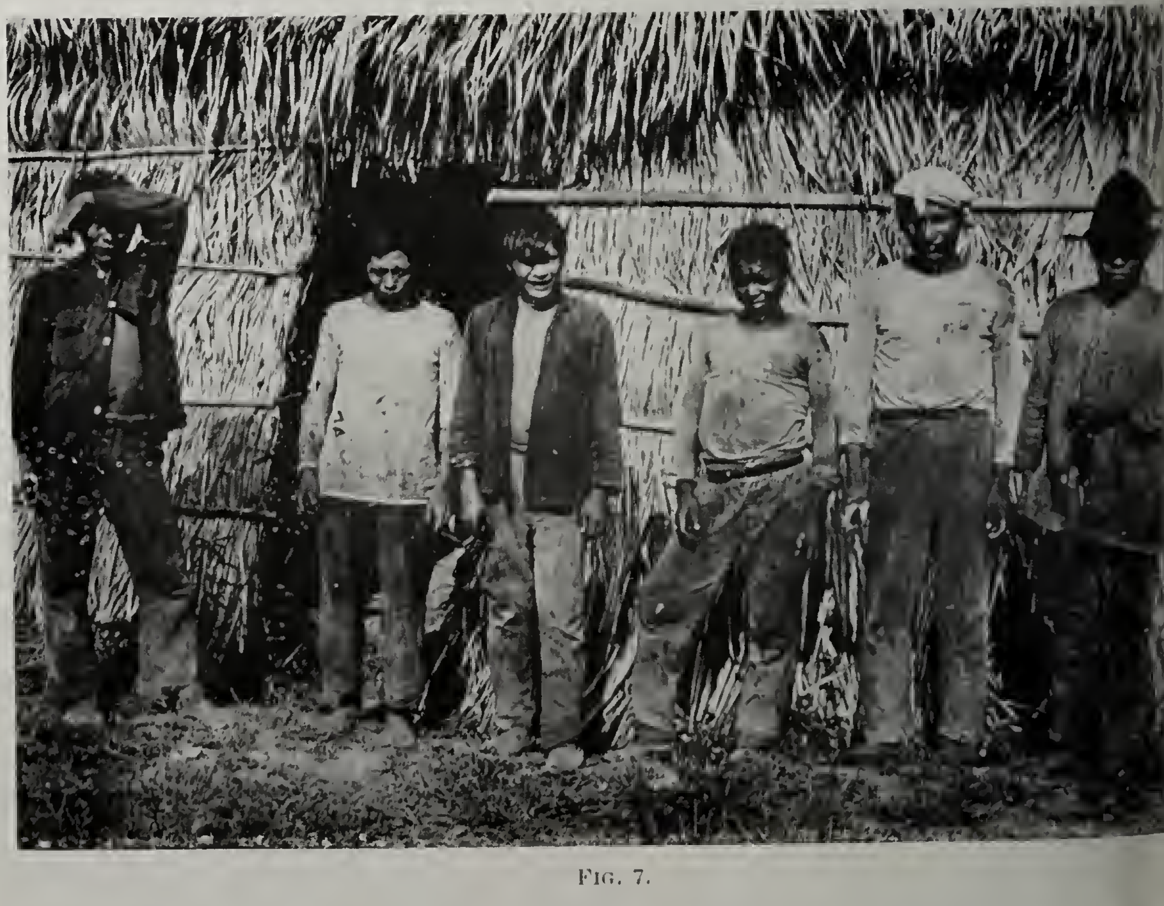

FIG. 7.

FIG. 6- Naturalist's camp in the forest. Red howler monkeys hanging from the line.

FIG. 7—Types of Maquiritare Indians and natives working in the rubber camp of Parraquete, an Turk, on the upper Orinoco.

FIG. 8.

FIG. 9.

FIG. 8—Cerro Duida from the lower Cunucunuma.
FIG. 9—San Fernando de Atabapo from the river bank.

stricted by the hand of man, attains its utmost development. Palms, fer lilies, and shrubbery are woven into an exquisite living tapestry by delica creepers which, festooning each possible hand-hold, twine ever back an forth, up and down, in their tireless efforts to conquer their more vigoro rivals, and all unconsciously produce one of nature's loveliest masterpiec

When rocks and low water barred further ascent we made camp on th high bank and began the arduous work of cutting a trail to Duida, abo six miles distant. We had secured the services of a number of Maquiritar two men, two women, and a boy, and these, together with the members o our crew, were immediately put to work on the trail. While this was i progress, we devoted ourselves to the exploration of the forest and i inhabitants.

Apparently the Indians, who, in common with many South America tribes, seek the smaller streams for their habitations, and who live in sma groups all along the Cunucunuma, rarely visited this locality. Game wa so abundant and so tame that it is certain that the animals had not bee persecuted to any considerable extent. We also visited the house of th chief of the tribe, named Antonio Yaracuma, whose *cunuco* (clearing) wa on the Cunucunuma, a few miles above the mouth of the Sina (Sina is Maquiritare word meaning wolf). This place he chose to call Yacar Surrounding the great, conical house was a small patch of yucas and pin apple plants, walled in on all sides by the interminable forest. The edg of the roof came down to within five feet of the ground, and there wer eight fire-places, equal distances apart, showing that eight families occupie the dwelling. A perfect network of poles and beams supported the ragge grass and palm-leaf canopy, and, from these, various articles were sus pended: drums, made of sections of hollow tree-trunks and covered wit the skin of a red howler monkey on one side and of a peccary on th other; long tubular baskets of wicker-work, used to express the poisonou juice of the yuca root in making manioc; blowguns ten feet long, ham mocks, and fishing tackle. Everything was immaculately clean and well arranged. On one side two small rooms had been built of adobe, one fo the chief, and the other for storing baskets of manioc, each of which held about a hundred pounds.

A walk around the edge of the clearing disclosed an obscure trail which zigzagged and wound through the forest about a mile and then opened into an immense plantation. This we estimated contained not less than a hundred acres. The trees had been cut down and burned, and yucas neatly planted in hills stretched to the very edge of the clearing. Through the center ran lanes of plantain and banana plants, bordered by rows of pineapples, sugar-cane, and cashews. The ground was carefully cultivated. and there were no weeds; the stalks of uprooted plants had been piled around the edge of the field, forming a thick fence. The reason for maintaining such large plantations is that the women make a good deal of

anioc to sell to the traders for cloth, matches, perfume, and trinkets. he men clear the ground; the women plant and care for the crops. From e juice of the yuca a very intoxicating drink called *casiri* is made, and of is great quantities are consumed during the wild orgies that take place frequent intervals.

We found the forest around camp to be all but impenetrable on account the underbrush and creepers. Also, there were a number of windfalls here cyclones had cut wide, clean swaths through the forest, leaving an pheaved barrier that could not be crossed without the liberal use of ax id *machete.* Small birds were abundant and traveled in large, mixed ocks. Of the bigger birds there was an unfailing supply; guans and urassows strutted unconcernedly about, or flew into the lower branches the trees to look with surprise or resentment at the intruder; large namous ran about in pairs like chickens and were slow to take wing. ccasionally we ran into a flock of trumpeters *(Psophia)* that stared at us curiosity for a few moments and then flew into a tree and raised an nearthly din, cackling and screaming until dispersed by a few shots.

The Indians told a curious story about a trumpeter and a curassow. the very beginning of things, two of these birds decided upon a matri-onial alliance, but domestic troubles soon broke out and there was no ssibility of a reconciliation; it was thereupon decided to lay the case fore the gods who live on the summit of Mount Duida. The wise gods dered them to fight it out; in the course of the combat that followed, e curassow pushed the trumpeter into the fire, burning off the feathers the latter's tail; the trumpeter promptly retaliated by pushing her mate to the fire, singeing his crest. Thereupon the gods decreed that they ould remain in this humiliating plight for the rest of their days, and even to this time the curassow wears a curled crest and the trumpeter is a very short tail.

No matter how far we chanced to go during the morning's hunt, it was ways easy to determine the exact location of our camp. A large colony *cassiques* had built their nests in the top of a tree near the tent, and iarreled and chirped so noisily all day long that we could not get out hearing of them.

After the trail had been completed for a distance of several miles, hunt-g was rendered much easier. It was a delight to wander noiselessly ong the clean path and watch the wild things pursuing their daily tivities. Tapirs slid quietly across the narrow lane, like shadows; but if sturbed crashed through the brush and thundered away like frightened orses. Large red squirrels frisked in the trees or fed in the nut-bearing ılms. Monkeys were always about; there were red howlers, cebus, and nall black woolly monkeys with gold-colored hands; the latter traveled small troops and raced through the tree-tops at great speed, making long umps from branch to branch; at frequent intervals during the morning

and evening they raised their voices in shrill little cries of distress rese
bling a series of quickly repeated Oh's.

The river was teeming with fish. At night, after their work had be
completed, the Indians, who camped on the water's edge, threw in th
lines and never failed to catch a goodly supply. While in our presence t
men always wore blue cotton trousers and the women loose dresses of t
same color; but when alone they threw aside all clothing.

Occasionally a light canoe containing women and children passed o
camping site, but they always remained as near as possible to the opposi
bank and paid no attention to us whatever if we chanced to call to the
in fact, they could not even be induced to look in our direction.

The nights were always sultry and it rained frequently. If the weath
permitted, a huge fire was built; into this a steady stream of fireflies
click-beetles winged their way to destruction. Late one night we hea
a queer pattering on the top of the tent-fly; back and forth raced littl
scurrying feet, and up and down the sloping roof. Our acetylene lam
revealed a family of opossums which had discovered an ideal playgroun
Often, too, we heard cautious footsteps near by, and the suddenly flash
light disclosed the glowing eyes of a deer, tapir, or jaguar which gaz
stupidly a moment into the dazzling brilliance and then darted away.

On account of the dampness, mould formed so rapidly that camer
and all leather goods had to be cleaned daily, and there was great difficult
in drying specimens.

We had frequent views of Duida. Each morning at about ten the mi
drifted from the summit and revealed the jagged, rocky peaks; our calc
lations placed the altitude of the mountain at approximately 5,500 fe
above the river. Toward the Orinoco, the mass presents a bold front, t
sheer walls of granite rising to a height of several thousand feet. Th
western slope is gradual, and any attempt to ascend the mountain shoul
be made from that side.

Cutting the trail required more time than we had anticipated. It wa
our intention to remove the equipment to the very base of Duida, an
this was impossible until a suitable way had been prepared. The inte
vening country is rolling and the hollows are filled with a network o
deep, water-filled canyons; across these, trees had to be felled to provid
a means of crossing. Neither the Maquiritares nor the Venezuelans prove
to be very industrious; in fact both were about as poor a class of assistant
as could be found. However, work progressed steadily, and there came th
day when the last bridge had been placed across the winding river, and w
were able to proceed to the foot of our goal.

Near the mountain, the vegetation assumes a different aspect. Instead o
the tall forest, there are vast groves of palms which form such a dens
canopy that the sunlight never penetrates to the ground; for this reaso
there is no undergrowth, but the earth is covered with a soft carpet of dr

eaves. Some of the palms attain such giant proportions, with fronds hirty or forty feet long and fifteen feet wide, that they form great tent-ike shelters.

As we neared the mountain the Indians became restive and finally efused to go any farther. They firmly believe that it is the abode of pirits, who will be quick to resent any intrusion into their sacred domain. Besides, the rainy season was fast approaching, and at night blinding ashes of lightning played among the crags, and the dull boom of distant hunder pierced the sultry blackness. Wind swept through the forest in tful blasts, and it rained frequently. Sometimes the gales attained the elocity of a cyclone and sent tall trees crashing down on all sides. The ndians could endure the strain no longer; so one night they quietly dis-ppeared, taking the boat with them. At first thought this loss seemed nything but pleasant; but a raft was soon constructed, and two of the nen were sent down to the nearest rubber camp on the Orinoco for another raft. We never saw the Indians again; but one afternoon two men of he tribe visited our camp. They emerged silently from the forest, having oncealed their canoe somewhere above or below, laden with baskets of plantains, sweet potatoes and bananas, and several cakes of cassava bread; lso, a large, freshly killed curassow—enough provisions to keep two men week. I thought they wanted to stop with us for the night and showed hem the fire-place. They paid no heed to my implied invitation but dropped their burdens at our feet, reluctantly accepted a few fish-hooks which were offered to them, and then departed as mysteriously as they had ome. Perhaps they had been sent by our erstwhile companions, who may have been conscientious enough to make some reparation for the theft f the canoe.

The rainy season advanced with such rapid strides that further work vas impossible. Vapor hung over the forest like a pall for days at a ime, and the river, rising with each passing hour, was quickly inundating he lowlands. The sight of the new canoe coming up the river was there-fore a welcome one, and it did not require many days to pack our collec-ions and outfit, stow them aboard, and steer a course downward with he rapid current. It required only nine days to reach San Fernando le Atabapo.

The results of the expedition are surprising and interesting. Duida s not the isolated "mountain island" it was commonly supposed to be, but is connected with the mountains of the Ventuari and Parima by a eries of hills, some of which reach a height of over a thousand feet. Its elevation is comparatively low, being less than that of the Maravaca; to attempt its ascent from the Orinoco side seems hopeless on account of the frowning precipices facing the plains near Esmeralda. The proper placing of the Cunucunuma and an elaboration of the map of the region were further results.

It should be remembered that the dry season is much shorter on t upper Orinoco than on the lower river, and work must be pushed wi the utmost speed. The tributaries of the Orinoco as well as the ma river leave their banks soon after the beginning of the steady downpou and the whole country is flooded many miles inland; all the rubber cam we had seen on the upward trip were totally deserted when we pass them going down, and of some of the huts the roofs only showed abo the water; others had vanished with the yellow flood.

The collections of birds and mammals were large and interesting; th yielded a number of species and one genus new to science.

Finally, a word about assistants; under no circumstances should Ven zuelans or Indians be depended upon. It is possible to secure experienc river-men in Trinidad, and, with proper treatment, they make faithful ar efficient companions.

EARLY EXPLORATION OF THE CHURCHILL RIVER

By J. B. TYRRELL

In the *Review* for December, 1916, Mr. Alcock gave an interesting account of the Churchill River,[1] the second in size of the two largest rivers that empty into Hudson Bay from the west. As the history of the exploration of this river is but slightly known, a few additional facts about the early surveys and journeys made on it may be of interest.

After its discovery by Jens Munck in 1619 very little attention was paid to the river until after Captain Gazer (Geyer) of the Hudson's Bay Company built York Factory on the northwest bank of Hayes River in 1684.[2] In 1688 the same company established a fishery for white porpoises at the mouth of the river. The existence of this fishery is recorded on an old French map of Hudson Bay, a copy of which is in the possession of the Canadian Archives in Ottawa. It is undated, but internal evidence shows it to have been made between 1691 and 1694. On this same map the Churchill River is shown up to and a little above the confluence of the Deer River, or for about thirty miles upwards from its mouth.

About 1718 the Hudson's Bay Company built a trading post within the mouth of the river, and in 1733 it began the construction of Fort Prince of Wales, the great stone fort on Eskimo Point.

In the years 1769 to 1772 Samuel Hearne made his three journeys inland from this fort, but he appears never to have made any attempt to survey the Churchill River, for on the great map of the world accompanying the account of Cook's third voyage,[3] which was issued in 1784, no indication is given of the course of the river above its mouth, though all the geographical information in the possession of the Hudson's Bay Company appears to have been incorporated on this map, including Hearne's surveys towards the Coppermine River, and two routes from York Factory to Cumberland House (approx. 54° N. and 102° W.) on the Saskatchewan River, one by the Nelson and Grass Rivers and the other by Hayes River and Lake Winnipeg. On the map in Hearne's own book on his journey,[4] published in 1795, the mouth of the river alone is indicated.

In 1775 Joseph Frobisher, a fur trader from Montreal, urged his canoes westward to Lake Superior and thence onward through Lake Winnipeg

[1] F. J. Alcock: The Churchill River, *Geogr. Rev.*, Vol. 2, 1916, pp. 433-448.

[2] For location of most of the geographical features here mentioned, see map in Mr. Alcock's article, p. 434.

[3] A Voyage to the Pacific Ocean Undertaken by the Command of His Majesty for Making Discoveries in the Northern Hemisphere, ... Performed under the Direction of Captains Cook, Clerke, and Gore in His Majesty's Ships the *Resolution* and *Discovery*, in the years 1776, 1777, 1778, 1779, and 1780, 3 vols., Published by order of the Lords Commissioners of the Admiralty, London, 1784.

[4] Samuel Hearne: A Journey from Prince of Wales's Fort in Hudson Bay to the Northern Ocean . . . . in the Years 1769, 1770, 1771, and 1772, London, 1795.

and up the Saskatchewan and Sturgeonweir Rivers to the Churchill River, which he reached at Frog, or Trade, Portage. Here, overlooking the river, the upper waters of which he had now discovered, he established himself for a time. His object was to intercept the northern Indians as they came down from the Athabaska country in their canoes loaded with furs to trade them for guns, ammunition, knives, and "English brandy" with the Hudson's Bay Company at Fort Prince of Wales. In this enterprise he was so successful that he was not able to carry away all the furs that he secured, and he established trade relations with the Indians from the Athabaska country which were maintained by him and by the company with which he was connected for the next forty-seven years.

The following year Alexander Henry and the brothers Joseph and Thomas Frobisher, all from Montreal, left the trading post on the shore of Beaver Lake in the present Province of Saskatchewan, in which they had been living, and went to Frog Portage, where they built a house. As the Indians from Lake Athabaska had not arrived they paddled up the Churchill River to meet them, going about as far as the mouth of the Mudjatick River (56° N. and 107⅔° W.), where they met a band with canoes loaded with furs. They turned about and came back with them to the house at Frog Portage, where they obtained from them 12,000 beaver skins, "besides large numbers of otter and martin," giving in return such articles as they had at the house.

After such a successful trade Alexander Henry and Joseph Frobisher returned to Montreal, while Thomas Frobisher went up the Churchill River to Isle à la Crosse, where he established a trading post.

In 1778 Peter Pond followed Frobisher's route from the Saskatchewan River by Frog Portage and up the Churchill River to Isle à la Crosse, whence he continued to its source near Methye Portage on his way to Lake Athabaska.

A few years later Pond drew several maps of western Canada, one of which is said to have been made for the Empress of Russia. One of these maps, dated 1785, has been published by L. J. Burpee in his "The Search for the Western Sea,"[5] while another, dated about 1790, has been published in the "Report of the Archives of Canada."[6] These maps are crude and imperfect, but the former one is the first that shows the Churchill River from its source to its mouth.

In 1787 Malcolm Ross, who four years later was associated with Philip Turnor in the survey of the upper Churchill River and Lake Athabaska, ascended the Churchill River from its mouth and crossed to Cumberland House on the Saskatchewan River, though by what route is not exactly known. It is probable that he went up the river through Northern and Southern Indian Lakes, and by Nelson House (56° N. and 100½° W.) and the upper waters of the Burntwood and Grass Rivers. Of this trip he

[5] Toronto, [1908], p. 182. [6] 1890, p. 53.

ported that he had "many difficulties to encounter before he reached umberland House from Churchill, the water so shoal as to prevent the navi- tion of small canoes." In commenting on the results of his trip Samuel earne says "no less could be expected; this river a little distance from here inaccessible for anything much heavier than a light canoe." In 1788, wever, Robert Longmore, an employee of the Hudson's Bay Company, as sent "to prosecute the discoveries from Churchill inland." Though he d not succeed in opening a trade route to the Saskatchewan, several ading posts were shortly afterwards established by the company up the hurchill River and in its vicinity.

In 1791 Philip Turnor, accompanied by Malcolm Ross, in charge of a rvey party sent out by the Hudson's Bay Company to survey and locate e position of Lake Athabaska, left Cumberland House on Saskatchewan aters, surveyed the Sturgeonweir River up to Frog Portage, and thence ade a track survey of the Churchill River up to its sources in Methye d Swan Lakes. His report and map were sent to the head office of the udson's Bay Company in London and his map was incorporated in rrowsmith's map of North America.[7] His original map, which appears have been remarkably correct, was copied by Kohl, and the copy is reserved in the Library of Congress in Washington.[8] A copy of this copy published in Burpee's "The Search for the Western Sea."[9]

In 1793 David Thompson,[10] then in the employ of the Hudson's Bay ompany, crossed Burntwood Portage (55½° N. and 100° W.) from the urntwood River into the Churchill River and surveyed that river to a oint 33 miles above Duck Portage (55⅔° N. and 102° W.).

He again reached Duck Portage in 1795, where he met George harles, an old schoolmate of his and then a fur-trader in the employ of he Hudson's Bay Company at Churchill, who had ascended the Churchill iver to this place. Though in the employ of the same company the two nen occupied separate trading posts, and, while competing with *Canadian* raders from Montreal, they also competed with each other for the furs hat were caught and brought to them by the Indians, and they sent the urs obtained in the winter's trade to different headquarters, Thompson ending his furs down the Burntwood and Nelson Rivers to York Factory nd Charles down the Churchill River to Fort Churchill.

In 1796 Thompson surveyed the Churchill River from Duck Portage p to the mouth of the Reindeer River, the Reindeer River to Reindeer

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[7] See footnote 13.

[8] Justin Winsor: The Kohl Collection (now in the Library of Congress) of Maps Relating to America a reprint of *Bibliogr. Contribution of the Library of Harvard University No. 19*), Library of Congress, Wash- ngton, 1904, map No. 39, listed on p. 74.

[9] p. 170.

[10] For an account of this eminent trader and surveyor's explorations see J. B. Tyrrell: David Thomp- on, A Great Geographer, *Geogr. Journ.*, Vol. 37, 1911, pp. 49-58, and "David Thompson's Narrative of His Explorations in Western America, 1784-1812," edited by J. B. Tyrrell, Toronto, 1916 (reviewed in the February *Review*, p. 156).—EDIT. NOTE.

Lake, and the west side of the lake up to the portage route to Wollasto Lake, beyond which he surveyed Wollaston Lake and Black River to th east end of Turnor's survey of Lake Athabaska. In 1797, while in th employ of the North-West Company, he surveyed the Churchill River fro the mouth of the Reindeer River to Frog Portage, on his way to Cumbe land House, and the following year he surveyed the river from Frog Portag upwards to Isle à la Crosse, making a detour on the route into Lac la Roug From Isle à la Crosse he ascended Beaver River, the principal upper bran of the Churchill River, past Green Lake to the source of the stream, whenc he carried his canoes to Lac la Biche, where he built a trading post. I May, 1799, he was on the Clearwater River, a branch of the Athabask which he ascended to Methye Portage, from which place he surveyed th Churchill River down to Isle à la Crosse, and thence checked his surve of the river made the year before down to Frog Portage.

The absurdity of maintaining two sets of trading posts on the Churchi River and the upper waters of the Burntwood River, both belonging t the Hudson's Bay Company, but one sending its furs down the Churchi River to Churchill and the other down the Burntwood and Nelson Rive to York Factory, was recognized in 1798, and the chiefs at York Facto recalled their traders and left the district to the men from Churchil From that time onwards until 1821, when the Hudson's Bay and Nort West Companies united under the former name, and perhaps for sever years after the union of the companies, the furs from this district whi were secured by the Hudson's Bay Company were carried down th Churchill River to Churchill, whence they were shipped to England.

In 1799 a trading expedition was sent from Fort Churchill up th Churchill River all the way to Green Lake on the Beaver River. It lef Churchill on June 26 in three boats and one or two canoes in charge o Messrs. Thomas Stayner and William Auld. Everything went well for while, but at about 130 miles from the fort, somewhere near the mouth o the Little Churchill River, the canoe containing the two principals wa upset in a rapid, and, though the men were saved by the accident of th tracking line becoming entangled in the loose rocks in the bottom of th river, the contents of the canoe were lost. On this account Stayner returne to Churchill, while Auld continued up the river and established a tradin post on Green Lake, where he spent the winter. On his arrival there h was greatly distressed to find that he had not brought enough brandy wit him, but on his appealing to some of the posts on the Saskatchewan Rive they helped him out.

In the same year Peter Fidler of the Hudson's Bay Company, unde direction from York Factory, left Cumberland House on the Saskatchewa waters and went by Frog Portage to the Churchill River, thence up tha river and its tributary, Sturgeonweir River, to Green Lake and Lac l Biche. Thus Fidler and Auld, one from York and the other from Churchill

ransferred the rivalry of these two centers from the country on the lower
) that on the upper portion of the Churchill River.

In 1804 and 1805 David Thompson, on behalf of the North-West Com-
any, was trading and surveying on the Churchill River as far downstream
s Southern Indian Lake, which was as far as he ever descended. Dur-
ıg this season and the preceding twelve years he had made track surveys,
hecked by great numbers of astronomical observations, of the river down
) this lake from its three principal sources, one at the head of the Beaver
River, near Lac la Biche (54¾° N. and 112° W.), and the others in Methye
nd Wollaston Lakes. He never had the opportunity of traveling over that
ortion of the river from Southern Indian Lake down to Hudson Bay.

In the winter of 1804-1805 Thompson was opposed in the fur trade
y his old schoolmate George Charles of the Hudson's Bay Company, who,
ke himself, had received a rudimentary education in surveying at the Grey
'oat School in London, though there is no published record that he ever
ıade use of his early training.

At that time there were three fur-trading posts on this lower portion
f the Churchill River, namely (Southern) Indian Lake, Granville Lake, or
Iusquawegun, and Nelson House. William Conelly, afterwards so well
nown in connection with the Hudson's Bay Company's affairs in British
'olumbia, was in charge for the North-West Company at Indian Lake,
)avid Thompson for the same company at Musquawegun, and George
'harles for the Hudson's Bay Company at Nelson House.

The following account of an incident which occurred during the previ-
us year in the conduct of the fur trade at Nelson House is given in Thomp-
on's own words[11]:

Oct. 2. In the evening paid a visit to Mr. Charles to enquire the reasons of his
eizing Louis Duplein. He informed me that in the spring on the arrival of all their
arty at this place, a Mr. Clarke deposed that Louis Duplein entered his tent with arms
nd forcibly took from thence a bundle containing 30 beaver skins, and that another
mall bundle of furs had been stolen out of his tent in the night previous to the above,
he wrapper of which small bundle he found in the morning at the door of the said Louis
)uplein. They all then proposed to seize him and take him down to Churchill to be
ried as Criminal for the above actions; but that he Mr. Charles overruled the motion
s not thinking it an affair of sufficient consequence to cause such violent measures.
But upon the arrival of Mr. Linklater &c. at the Factory (Fort Churchill) they by their
epresentations to the Trader there got an order to seize on the person of Louis
)uplein, commanding all persons that should be found present to be aiding in seizing
he said Louis Duplein. In consequence of which, when they arrived in the summer,
fter having settled their affairs and ready to return to the Factory, they invited Louis
)uplein to breakfast, which invitation like a blockhead he accepted (for they had no
ntention of entering the N. W. Co.'s House to seize him). At breakfast they asked
ouis Duplein if he actually took by force the above 30 skins from Mr. Clarke, to
which he replied in the affirmative, owning his guilt and offering to pay half the skins
n the spot. Having thus declared himself guilty they were obliged to seize him and
ut his hands in irons. They then embarked him, leaving orders with their clerk at

[11] Thompson's MS. notebooks in the Provincial Archives of the Province of Ontario, Toronto.

the Indian Lake to aid and assist Du Bois in the care of the N. W. Co.'s property ti some person should arrive to take charge of it. He further added that on the arriva of the ship from England the opinions of the Commander and officers of the ship wer that Louis Duplein would be hanged, and that they did not see any likelihood of hi escaping the rigour of the law.

Several years before Thompson reached Indian Lake some one, doubtles one of the men in the employ of the Hudson's Bay Company, had made survey of the lower portion of the river, for in the general map accom panying Mackenzie's "Voyages,"[12] which is dated October 15, 1801, thi portion is shown with a rough approximation to correctness up to abou the position of Nelson House in 55° 50′ N. and 100° 30′ W. Above that up to near the mouth of the Reindeer River, it is shown by a dotte line. The positions of the lakes are merely indicated on this map withou shores on either side, giving the impression that the surveyor, like man another surveyor down to the present day, noted his directions and dis tances, but made no attempt to sketch in the surrounding country. It i clear also that the map was not copied from a sketch made by an Indian for in that case there would have been some indication of the shapes of th lakes. This map is said to have been "reduced by Mr. Arrowsmith fro his three-sheet map of North America, with the latest discoveries, which h is about to republish."

In the 1802 edition of Arrowsmith's own map[13] the dotted line on th above map is replaced by a solid one, but no details are indicated.

Later surveys of the lower part of the river made during the early par of the last century appear to have been the work of Peter Fidler.[14] In 180 he repeated some of Thompson's surveys of the Reindeer River and Reinde Lake. In 1809 it is probable that he made a survey of the Churchill Rive from its mouth up to Isle à la Crosse, and in the following year that h surveyed the Seal and Paukatakuskow Rivers, north of Churchill, fro Hudson Bay to Southern and Northern Indian Lakes respectively, as a these three streams are shown on the edition of Arrowsmith's "Map of th Interior Parts of North America" dated June 14, 1811.

From that time onward till 1879, when Robert Bell of the Geologic Survey of Canada descended the river from the confluence of the Litt Churchill River to its mouth, nothing was added to the knowledge of th geography of the lower part of the river.

As stated above, the Churchill River was regularly used as a trad route from about 1792 down to the time of the union of the Hudson's Ba

[12] Alexander Mackenzie: Voyages from Montreal on the River St. Lawrence, Through the Contine of North America, to the Frozen and Pacific Oceans, in the Years 1789 and 1793. London, 1801.

[13] A Map Exhibiting All the New Discoveries in the Interior Parts of North America, Inscribed Permission to the Honorable Governor and Company of Adventurers of England Trading into Huds Bay, in Testimony of Their Liberal Communications to Their Most Obedient and Very Humble Serva A. Arrowsmith, January 1st, 1795, [1:4,500,000], London, A. Arrowsmith, 1795; additions to 1802.

[14] See J. B. Tyrrell: Peter Fidler, Trader and Surveyor, 1769 to 1822, *Proc. and Trans. Royal Soc. Canada*, 3rd Series, Vol. 7, 1913, Section 2, pp. 117-127.—Edit. Note.

nd North-West Companies in 1821. In this latter year there were two dis-
ricts on the river and in its vicinity, known respectively as Old and New
'hurchill Districts. In Old Churchill District there was only one trading
ost, namely, Fort Churchill, near the shore of Hudson Bay. In New
'hurchill District there were in all five trading posts, three of which,
amely, Indian Lake, Nelson House, and Reindeer Lake, were on the
'hurchill River or its tributaries, while the other two at Net (Setting) and
plit Lakes were on the waters of the Nelson River. The Chief Factor,
ohn Charles, had his residence at Indian Lake, and every year he brought
upplies up the Churchill River from Fort Churchill, and distributed them
) the above-named trading posts, after which he collected the furs from
hese posts and took, or sent, them down the same river to Fort Churchill
) be shipped to England.

A few years after this date, but just how many I do not know, the num-
er of trading posts maintained by the company was considerably reduced,
nd several of the more northern ones were abandoned, including most of
nose on the lower portion of the Churchill River, for the old-time competi-
on between the North-West and Hudson's Bay Companies was now a thing
f the past, and, as the Indians were confined to the traders of the Hudson's
ay Company for their supplies, they could be depended on to come much
nger distances to the trading posts than formerly. About the same time
ne Churchill River was abandoned as a trade route from the interior
ountry to the coast; the Indians soon ceased to travel up or down its
eacherous current; and before long the fact that it had ever been used
s a regular trade route was almost entirely forgotten.

THE HISTORY OF THE FORTY-NINTH PARALLEL SURVE
WEST OF THE ROCKY MOUNTAINS

By OTTO KLOTZ

The object of this paper is to tell the—one may almost say—romanti story of the survey in 1857-61 of the boundary between the United Stat and Canada along the forty-ninth parallel west of the summit of the Rock Mountains and to relate how the final report, which had been lost unt that time, was found in July, 1898.

In order to give adequate meaning to that discovery, it is necessary t review briefly the history of the boundary line. By the treaty of June 1 1846, signed by James Buchanan and Richard Pakenham, between th United States and Great Britain, Article I, describing the boundary lin reads[1]:

> From the point on the forty-ninth parallel of north latitude where the bounda laid down in existing treaties and conventions between the United States and Gre Britain terminates, the line of boundary between the territories of the United Stat and those of Her Britannic Majesty shall be continued westward along the said fort ninth parallel of north latitude to the middle of the channel which separates the con nent from Vancouver's Island, and thence southerly through the middle of said chann and Fuca's Straits, to the Pacific Ocean: *Provided, however,* That the navigation of t whole of said channel and straits south of the forty-ninth parallel of north latitu remain free and open to both parties.

In the official correspondence of the time the section of the bounda between the summit of the Rocky Mountains and the Strait of Georgia spoken of as the "land boundary" to distinguish it from its western co tinuation through the strait separating Vancouver Island from the mai land, which was designated the "water boundary." Throughout this artic the land boundary, along the forty-ninth parallel, is alone considered.

It was not until ten years later, on August 11, 1856, that Congre authorized the appointment of a commission which, with a similar comm sion to be appointed by Great Britain, was to carry out the provisions the above Article I. Archibald Campbell was appointed the United Stat commissioner and Col. J. S. Hawkins the British commissioner, and Maj J. G. Parke and Capt. R. W. Haig were appointed the respective astron mers. Field operations were begun in 1857 and concluded in 1861. is interesting to note the arrangement made August 13, 1858, by the joi commission[2]:

> After discussing plans for determining and marking the line as far eastward [fr the Strait of Georgia] as the Cascade Mountains, it was concluded to be inexpedi

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[1] Treaties and Conventions Concluded between the United States and Other Powers. State De Washington, 1889, p. 438; also *U. S. Geol. Survey Bull. 226*, 1904, p. 19.

[2] Foreign Office Correspondence, Part III, p. 16, Office of the Chief Astronomer, Dept. of the Inter Ottawa, 1899 (see also footnote 6).

the present time, in consequence of the great expense, consumption of time, and the npracticable nature of the country, to mark the whole boundary by cutting a track rough the dense forest. It was therefore agreed to ascertain certain points on the ie by the determination of astronomical points at convenient intervals on or near the undary, and to mark such astronomical stations, or points fixed on the parallel formg the boundary, by cutting a track of not less than 20 feet in width on each side for e distance of half a mile or more, according to circumstances. Further, that the undary be determined and similarly marked where it crosses streams of any size, rmanent trails, or any striking natural features of the country. In the vicinity of ttlements on or near the line, it is deemed advisable to cut the track for a greater stance, and to mark it in a manner to be determined hereafter.

Although the survey was completed late in 1861 it was not until May 1869, that the final report was signed at Washington by the two comissioners. A very important agreement[3] was reached on that day by the o commissioners, when they decided—

it, between any two successive defined points, marked on the ground, shown on the ps, and set forth in the accompanying lists, the line of boundary above described is be considered a right or straight line; and that this rule is to apply throughout the ire boundary without regard to the distances between the consecutive points or to course of the parallel in such intervals.

olonel Hawkins, writing on May 10, 1869, to the Foreign Office and ferring to this agreement, says[4]: "We were induced to do this upon conleration that it was of the greatest importance nothing should be left *future* discussion or settlement and that our operations should be final d conclusive."

It should be observed that the observations of the two commissions were de with the utmost attainable precision and are comparable with the best ld work of today. The position of the parallel in the 410 miles of its gth was determined from twenty-eight astronomical stations, eleven of ich were established by the British commission, fourteen by the United tes commission, and three by joint observations. The total expense of the ited States commission was approximately $600,000, equivalent to about 460 per mile. We may assume that the expense of the British commission s about the same, although the figures are not available. Ultimately maps of the survey were published, seven sheets on the scale of 1:60,000 e index map, Fig. 1).[5]

Such were the methods used in establishing the boundary line, which across a wild, generally forested country with no population save in ated spots. Where is the boundary? and Which line is it? were quesis that arose later with the advent of settlers in the more open country ween the Similkameen River and the Columbia.

As squatters and settlers began to occupy lands on both sides of the ndary line they found in places three lines cut through the woods, as l as two sets of stone cairns, which naturally left them in a quandary

Ibid., Part IV, p. 7. [4] *Ibid.*, p. 5.

And publication cited in footnote 9, pp. 22-23.

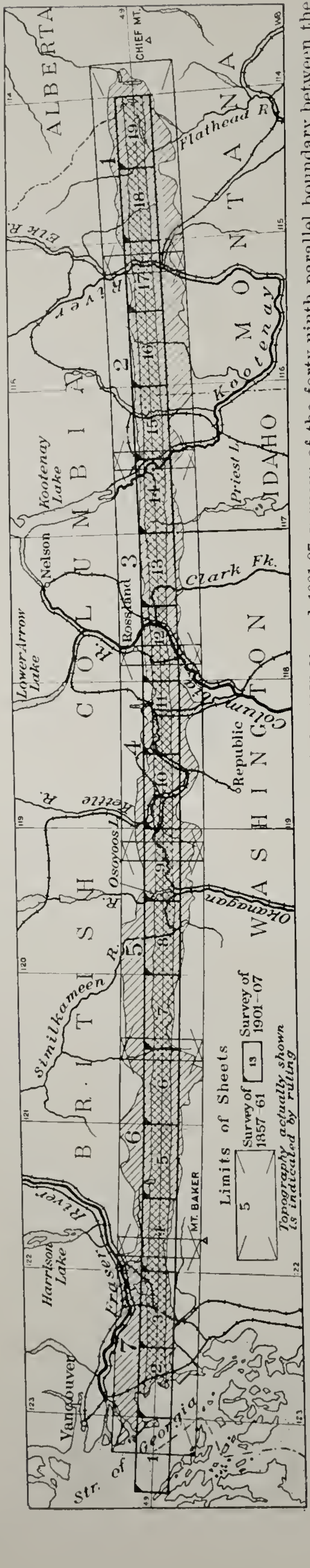

FIG. 1—Index map showing the limits and arrangement of the map sheets of the 1857-61 and 1901-07 surveys of the forty-ninth parallel boundary between the United States and Canada west of the summit of the Rocky Mountains. Scale, 1:4,000,000, or about 63 miles to 1 inch. The ruling indicates the extent of the topography actually shown in each case.

as to where the definite boundary line w Settlers on the Canadian side applied to t provincial government at Victoria for the n essary information. But none could be su plied from that source. That governm referred the question to the federal auth ities at Ottawa, but here, too, no records w available. It seemed obvious that it wo only be necessary to write to London to obt the desired information and a copy of final report of the survey of 1857-61. Now extraordinary happened. This final rep with the necessary data of the survey was to be found in London. Time and again sea was made by different persons for the miss documents, but all to no avail. To add to remarkable situation, the duplicate final port was not to be found in any of the gove ment archives in Washington. Does hist record any similar circumstance? Two g ernments are engaged for years on an exp sive international work, a boundary surv the respective commissioners sign joint fi reports and transmit them to their respec governments; and the reports are nowher be found! The apparently impossible happened, and the outlook was that in the n future a new survey under another inte tional commission would have to be made.

Such was the situation in 1898 when writer was sent by the Dominion Governm to London and Petrograd on a special miss in which was included the obtaining of in mation regarding the records and final re of the survey. All the Government office London were visited in which there was faintest likelihood that the records migh stored, but all to no avail, and no one see to be able to give any assistance. Be leaving England, however, the writer astronomer for the Dominion Governm naturally paid a visit to the Royal Obse tory at Greenwich. By chance his eye ca the initials B. N. A. on some boxes on to

ie library shelves—letters at once interpreted as possibly standing for British North America.'' The boxes were taken down, the dust of years emoved, and in them lay the long-lost records of the international survey f the forty-ninth parallel.

The final report, dated May 7, 1869, and jointly signed by the two ommissioners, together with other official correspondence pertaining to ie boundary, has since been published by the Office of Chief Astronomer, epartment of the Interior, Ottawa.[6]

With the material found it was now possible to understand all the perations of the survey, the method of placing the monuments, the reason r the existence of diverging lines cut through the forest, and the meaning f duplicate cairns. The occurrence of the last was due to the non-removal y the men as instructed of those cairns which no longer indicated the osition of the accepted boundary line.

In order to understand how and why unavoidable difficulties arose in aking the demarcation of the boundary line continuous, it is necessary say a word about astronomical observations for latitude. The zero from hich latitude observations are made is indicated by the "level," and its osition in turn is the resultant of all the gravitational forces acting on it. ountainous regions generally show deflections of the plumb line, due to iomalous distribution of matter. Were there no anomalies it would be ssible theoretically, after establishing an individual point on any parallel latitude, to establish other points on the parallel from it. Or we may y that, if two points are established, the direction a straight line must ke from the one point to the other is simply a matter of computation. the present case the effect of this condition was most noticeable in the 5 miles from the Similkameen River to the Columbia, where most of the uplicate cuttings in the forest were found. In a letter dated March 28, 861, and addressed to the Secretary of State, Colonel Hawkins said[7]:

> If the actual boundary was to be defined by the joint commission in any part of e space intervening between the waters of the Pacific and the Rocky Mountains, the erval between the Similkameen and the Columbia Rivers is not only of as much portance as, if not of greater importance than, any other part of the line, but it also esented greater facilities for the performance of the necessary operations, while embraces about a fourth of the whole extent of land boundary comprehended in the aty under which the commission was appointed.

The astronomic stations in this section of the boundary were, in order om west to east: Similkameen (119° 35′ W.; U. S.); Osoyoos (119° 24′; .); First Crossing, or Newhoilpitkw (118° 44′; U. S.); Second Crossing, Inshwointum (118° 28′; Br.); Third Crossing, or Statapoosten (118° ′; U. S.); Columbia (117° 38′; Br. and U. S.). It will be remembered at it was agreed to project the boundary line a short distance east and st from each astronomic station. This was done. From the British

[6] Foreign Office Correspondence, Parts III and IV, Ottawa, 1899.
[7] *Ibid.*, Part III, p. 41, Ottawa, 1899.

station at Osoyoos, the British commission ran lines—cutting the for where encountered—west and east to meet the United States astronom stations respectively at Similkameen and at the First Crossing, and similar from the Second Crossing again to the First Crossing and eastward to t Third Crossing. The not-unexpected happened—the lines did not me owing to "local deflection of the plumb line," although the discrepanc were greater than expected. At Similkameen the line came 509 feet nor of the United States station; at the First Crossing the Osoyoos line ca 364 feet north of the United States station, but the line projected from t Second Crossing westward came 300 feet south of this same United Sta station; i. e., the two British lines run from British stations were 664 f apart. This was not attributable to any error in the work, for the wo was well done, but to the inherent idiosyncrasies of the environing m distribution. Because of this operation of connecting or trying to conn the astronomic stations there now were two lines cut at each of the th United States stations. Things could not be left in this condition. Af discussion by the officers of the two commissions on March 4, 1861, "it w agreed that a mean parallel should be adopted, and a new line run a marked from the Similkameen to Statapoosten."[8] And this new line w run and marked by the United States commission. Thus in places a thi line was cut; this was the definitive line. This explains why on the grou several vistas through the woods existed side by side. From the posit of the mean parallel at Statapoosten the British commission subsequen ran the line to connect with the astronomic stations on the Colum Here, too, the line suffered a deflection to the north, namely, of 212 f As already mentioned the cairns should all have been removed from preliminary lines joining astronomic stations and only those left wh were on the final line. The circumstance that this was not done ad to subsequent mystification; but the finding of the original records final report cleared up everything.

It may be interesting to continue the story and recount what happe in Washington. Marcus Baker, cartographer, made a report[9] on June 1900, to the director of the U. S. Geological Survey on this boundary l He searched the various departments in Washington for documents taining to the survey and had personal interviews and correspondence w men then living who had been officially connected with the boundary surv with a view to throwing light, if possible, on "the most important docum of all," the final report, but failed. Baker quotes[10] from the 1889 rep of Capt. George M. Wheeler, U. S. A., as follows:

> I have been unable to trace the manuscript of the final report, including that of chief astronomer and the specialists, which it was believed was made. Accordin the Journal of the Senate of February 9, 1871, this report was called for by the Sen

[8] Foreign Office Correspondence, Part III, p. 57, Ottawa, 1899.

[9] Survey of the Northwestern Boundary of the United States, *U. S. Geol. Survey Bull. 174*, Washington,

[10] *Ibid.*, p. 11.

it a search of the Senate records and also those of the State Department, made at my quest by Mr. Dwight, librarian of the State Department, remained unavailing on ine 15, 1887. Mr. William J. Warren, secretary of the commissioner [and] now chief erk [in the office] of the [Chief of] Engineer[s], [War] Department, recollects to ive seen the manuscript of this report at the office of the Northern Boundary [Survey], established in 1873, as does also Major J. F. Gregory, Corps of Engineers, a ember of that commission, but it could not be found by Mr. Dwight in the records ansmitted at the close of the latter survey to the State Department.

Baker adds to the above: "The search above mentioned I have now peated and with like result. The manuscript has not been found." arther on[11] Baker writes: "But the report, unfortunately, was not pubshed, and the manuscript has for many years been lost to view. Its whereouts are still unknown. The reason it was not published, I am informed, that Mr. Fish, Secretary of State at that time, deemed its publication o expensive. The war had brought a mountain of debt, and under these nditions he refused to sanction so costly a publication."

Such were the vicissitudes of the 1857-61 survey. In 1900 it was decided re-mark the boundary in order that there might be no doubt as to its act position—a condition made necessary by the increased settlement and onomic development of the region. Commissioners were appointed as llows: Dr. W. F. King, Chief Astronomer of the Canadian Department the Interior, for Great Britain; and Dr. C. D. Walcott, Director of the . S. Geological Survey, and Dr. O. H. Tittmann, Superintendent of e U. S. Coast and Geodetic Survey, for the United States. The survey was carried out in the years 1901-07, and the final map, in 19 sheets the scale of 1:62,500, was published in 1913 (see index map, Fig. 1).[12] network of triangulation was established,[13] monuments were placed at equent intervals, and in the forested areas a clear sky-line was cut. owever, the line, as now marked and cleared throughout, is based on e monuments and positions established in the original survey of 1857-61. ie fortunate find of the lost report "doubtless prevented complications hich might otherwise have arisen as to the details of the boundary and viated the necessity of a new treaty or of special provisions in the general eaty."[14]

[11] *Ibid.*, pp. 17-18.

[12] And review under "North America, General" in the section "Geographical Publications," below.

[13] See diagram in *Rept. Supt. Coast and Geodetic Survey, 1903-1904*, p. 149. For account of the operations he Survey see the annual reports of this bureau from that for 1902-03 to that for 1908-09.

[14] O. H. Tittmann: Our Northern Boundaries. *Journ. Washington Acad. of Sci.*, Vol. 4, 1914, No. 3.

FURTHER CONTRIBUTIONS TO THE PROBLEM OF ATLANTIS

The discussion in the January *Review,* by Professor Schuchert a[...]
Dr. Schuller, of Termier's paper on Atlantis, the "lost" continent, h[...]
called forth the following two papers by Mr. Edwin Swift Balch, Council[...]
of this Society, and Mr. William H. Babcock, a private collector of Was[...]
ington, D. C., who has recently made an extensive investigation of a relat[...]
topic from the standpoint of early cartography.[1] The present pap[...]
furnish additional material on this vexed problem. The one suggests [...]
identification of locality different from that favored by geologists, whi[...]
considers the sunken land-mass whose remnants are the Canary and Ca[...]
Verde Islands to be the "lost" continent of the ancient myth; while t[...]
other discusses the improbability of any connection between the nam[...]
Atlantis and Antilles.

Atlantis or Minoan Crete

By EDWIN SWIFT BALCH

The lost Atlantis of Plato has been for many years if not centuries [...]
subject of discussion and controversy. It is usually assumed to have b[...]
located in the Atlantic Ocean somewhere off the coast of the Sahara Des[...]
This solution of the puzzle, however, has never been definitely accept[...]
and the matter is constantly being reargued afresh. Professor Termie[...]
interesting paper on Atlantis, recently reviewed in these pages, brin[...]
forward anew the theory of the location of Atlantis in the Atlantic Oce[...]
In view of this, it seems well to say a few words about the theory—bri[...]
mentioned by Mr. James Baikie in his book "The Sea Kings of Crete[...]
and said by him to have been broached by an anonymous writer in [...]
English newspaper a year or two earlier—that the lost Atlantis of Plato [...]
really Minoan Crete.

The theory that Atlantis is Minoan Crete could only have been star[...]
since 1900, for up to the end of the nineteenth century Turkish suzerai[...]
over this island of the Ægean prevented all archeological work. But w[...]
the first sods upturned by the archeologists's spade great results w[...]
obtained. Gournia and Phaistos and Knossos with its fine palace w[...]
unearthed, and before long the world realized that in Crete there had o[...]
been a totally forgotten civilization which extended over not less than t[...]

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[1] The So-called Mythical Islands of the Atlantic in Mediæval Maps, *Scottish Geogr. Mag.*, Vol. 31, pp. 261-269, 315-320, 360-371, 411-422, 531-541; Vol. 32, 1916, pp. 73-79, 131-140, 418-428, 477-484.

[2] A. and C. Black, London, 1910; reference on pp. 256-259 (see review in *Bull. Amer. Geogr. Soc.*, Vo[...] 1912, pp. 382-383).

usand years and which came to a sudden end in about the year 1200 B. C. reover, during most of its existence the Minoan kingdom was in touch h Egypt; the last Egyptian relics found in Crete, according to Flinders rie, date from about the year 1200 B. C., thus apparently coinciding h the downfall of Minoan civilization.

If one looks at Plato's statements about Atlantis, which are republished some length in Termier's article, it soon becomes apparent that they a very confused jumble of ideas. This is probably due to several causes. e is that Plato did not hear the story of the Egyptian priest himself, only heard it at second or rather at third hand. The story as told by priest himself to Solon was probably confused enough, and when it ched Plato it was still more confused. Then again the story related an event which happened at the least not less than six hundred years fore. Historical records in Plato's time were not kept with anything e the accuracy with which they are kept now, yet just consider what we uld know of the invasion of England by William the Conqueror if, from day to this, there had been absolutely no intercourse between England l America.

One of the facts which it seems can be gathered with some certainty m Plato's narrative is that Atlantis was a large island. Of its sur- ndings he says: "From this island you could easily pass to other ands, and from them to the entire continent which surrounds the interior . What there is on this side of the strait of which we are speaking sembles a vast gateway . . . and the land which surrounds it is a real ntinent." That is to say, there were other islands near Atlantis and se were in an interior sea near to a continent. These geographical data ply perfectly to Crete and the Ægean Sea.

Another fact which may be extracted with some certainty from Plato's rrative is that Atlantis was a kingdom of some extent and power. Its ngs "had under their dominion the entire island as well as several other ands and some parts of the continent. Besides on the hither side of the ait they were still reigning over Libya as far as Egypt and over Europe far as the Tyrrhenian." These statements may perfectly well apply to inoan Crete. Crete may easily have ruled over many of the islands of e Ægean, it may well have ruled over the Peloponnesus at the time Mycenæ and Tiryns, it may well have ruled over the North African ast of the Cyrenaica. This is certainly far more probable than that a ople living in the Atlantic Ocean should have ruled over Morocco, lgeria, Tripoli, and the Cyrenaica as far as the valley of the Nile. And they had they would certainly have left some relics of their occupation, it no relics of any such people have been found in North Africa.

Plato not only tells us that Atlantis was a large island, but he gives short account of it which Termier condenses or translates as follows: ne of Plato's characters, Critias, "describes the cradle of the Atlantean

race; a plain located near the sea opening in the central part of the islan and the most fertile of plains; about it a circle of mountains stretchin to the sea, a circle open at the center and protecting the plain from the i blasts of the north; in these superb mountains, numerous villages, rich an populous; in the plain, a magnificent city, the palaces and temples of whi are constructed from stones of three colors—white, black, and red—draw from the very bosom of the island; here and there mines yielding all t minerals useful to man; finally the shores of the island cut perpendic larly and commanding from above the tumultuous sea." Now this is accurate description of Crete and Knossos, and as far as they are co cerned there is nothing fanciful about it.

According to Plato the destruction of Atlantis was the joint work Egypt and Athens. The old Egyptian priest told Solon "The recor inform us of the destruction by Athens of a singularly powerful ar . . . All this power was once upon a time united in order by a sin blow to subjugate our country, your own, and all the peoples living the hither side of the strait. It was then that the strength and coura of Athens blazed forth." Apparently Egypt and Athens together put end to some kingdom threatening them both. And certainly this points Minoan Crete, whose central location might well have threatened t Egyptian and Athenian allies and whose civilization we know was wip out absolutely about 1200 B. C.

Is there any recollection of Crete and its destruction in Greek record It seems as if there were in the shape of the legendary Minotaur, terrible monster who devoured so many Greek youths and maidens. B literally translated, Minotaur means the bull of Minos, and we can see the museums of our chief cities copies of the frescoes from the Palace Knossos representing the slaughter of Greek prisoners in the Minoan b fights. And the Minotaur, Greek mythology tells us, was destroyed Theseus, which would seem to be a reminiscence of the destruction Minoan Crete by Athenians and Egyptians.

The passage in Plato which has led most strongly to the belief t Atlantis was an Atlantic island, a belief seemingly to some extent justifi before the archeological discovery of Minoan Crete, is the following: "T records inform us of the destruction by Athens of a singularly power army, an army which came from the Atlantic Ocean and which had t effrontery to invade Europe and Asia; for this sea was then navigal and beyond the strait which you call the Pillars of Hercules there w an island larger than Libya and even Asia." This is surely a most co fused muddle of names and ideas, representing hopelessly confused notio of geography.

Consider the statement that "there was an island larger than Lib and even Asia." The size assigned to Atlantis shows definitely the la of accuracy of the whole passage. Did the Egyptians or the Greeks

year 600 B. C. have any knowledge of the Atlantic Ocean? There no record of anything of the kind, beyond the one in Herodotus saying t before his time some Phœnician navigators had sailed around the rican continent. Is there any warrant for believing that the name illars of Hercules'' originally applied to the Rock of Tarik and the untain masses of Morocco? We should not assume Egyptian and early eek notions of geography to have been anything like our own. They ld not have been. Does not the most probable explanation of Plato's tement seem to be that by the Atlantic Ocean or a navigable sea he ant the Mediterranean and by the Pillars of Hercules some passage ween high rocks in the Ægean, rather than what is meant by our sent nomenclature?

It is especially in the passages in Plato which are hard to interpret t we must remember that Plato is not telling us something at first nd. Plato tells us that he learned from Solon that an Egyptian priest l told Solon a historical tale which the priest had read in the sacred oks. We have thus not the original story as told in the sacred books, t a verbal version of it transmitted verbally through three minds before ching us. Exactly what was in the sacred books we shall probably never ow, but as far as the passage in Plato is concerned which has caused much speculation—''an army which came from the Atlantic Ocean''— seems quite possible that the name ''Atlantic Ocean'' was not in the red books at all.

Another passage in Plato is also hard to interpret. ''Later with great rthquakes and inundations, in a single day and one fatal night, all who d been warriors against you were swallowed up. The island of Atlantis sappeared beneath the sea. Since that time the sea in those quarters has come unnavigable; vessels cannot pass there because of the sands which tend over the site of the buried isle.'' ''The sea has become unvigable.'' What sea? Certainly not the Atlantic Ocean, nor the Mediranean either! ''Vessels cannot pass there'' implies commerce on the rt of Egypt. But did Egypt ever have any commerce in the Atlantic? rtainly there is no record of anything of the kind. Does it not seem proble that Plato's remarks are a garbled report of the extermination by gyptians and Greeks of the Minoan Cretans, after which commerce with ete stopped? At any rate, this explanation would seem to interpret to me extent this perhaps most confused of all the passages in Plato, a ssage whose original form in the sacred books was very probably quite fferent.

The geological evidences advanced of the existence of a sunken continent island in the Atlantic may be quite accurate. Geologists, however, seem ry much in the dark about the time at which such an Atlantic island ay have become submerged. They are uncertain as to whether it took lace in the Eocene, the Miocene, or the Pliocene. Now supposing such

a submergence occurred even only as late as the Pliocene, what would mean in regard to Atlantis? Our present, or Recent, short geological peric was preceded by the Pleistocene, which was preceded by the Pliocene. Tl length of the Pleistocene is variously estimated, but a conservative estima is about 500,000 years. This would place the submergence of the lan in the Atlantic, if it occurred in the Pliocene, more than 500,000 years ag Now can any one seriously maintain that any of the Egyptians, whe Dynastic and Predynastic remains can hardly date back over 10,000 year could have a tradition of an occurrence in the Atlantic dating back mo than half a million years?

It is, of course, very probable that there were early men living in tl late Pliocene. The famous Piltdown skull, about which so much poth has been raised of late, is considered by many competent archeologists t date from Pliocene times. Piltdown man was also sufficiently differe from modern man to have been assigned to a separate class and to hav been named after his discoverer *Eoanthropus Dawsoni*. The implemen found in connection with the Piltdown skull are of the roughest chippe stone type, eoliths. Now, supposing that there were any Piltdown men o the sunken lands in the Atlantic, could any one pretend to believe that the were capable of building a city and palaces of white, black, and red buil ing stones?

The theory which has been so long and so frequently the subject of co troversy, namely, that Plato's Atlantis was in the Atlantic, seems untenab in the light of modern science. The theory that Plato's Atlantis wa Minoan Crete, on the contrary, seems to stand up very well before rece archeological discoveries. At any rate it deserves to be more widely know for it certainly seems to meet fairly completely the facts which the ol Egyptian priest was trying to tell Solon and Solon to tell Plato of th destruction of what seems to have been the then already nearly forgotte civilization of Minoan Crete.

ATLANTIS AND ANTILLIA

By WILLIAM H. BABCOCK

In his discussion of Termier's paper in the January *Review* Dr. Schulle charges with *petitio principii* the French geologist's announcement tha he awaits "the final answer" to the problem of Atlantis from anthropolog and oceanography; also Dr. Hrdlicka's conclusion, from very considerab and persuasive evidence, that the American Indians came from Asia. Th ancient and well-worn phrase seems a curious misfit in both instances Both also are likely to define for a long time—the latter permanently— the general attitude of informed and thinking men.

But real and unwarranted assumption or question-begging is to be ound in Dr. Schuller's own utterances. He observes of Atlantis: "As an sland it is preserved on the first cartographical productions. After the iscovery of America, its name, in the form of 'the Antilles,' was given to he islands at present termed 'West Indies.'"

Clearly, this allusion must be to the delineation of Antillia appearing n the fifteenth-century maps from Beccario,[1] 1435, and Bianco,[2] 1436, nward to the time of Columbus; but not found in the fourteenth-century naps, e. g., Dalorto,[3] 1325; Dulcert,[4] 1339; Laurenziano-Gaddiano,[5] 1351; 'izigano, 1367[6] and 1373,[7] and the slightly later ones of Solcri,[8] Pinelli, etc. [or is it in Edrisi's twelfth-century maps of the Atlantic islands[9] preserved n the copies of the Pococke and Greaves's Arabic manuscripts. These two ersions differ somewhat in details; but no link exists between any Edrisi land and either Antillia or Atlantis. Nor are there any intervening or arlier maps, yet reported, which offer any basis for Dr. Schuller's atement.

Plainly, then, the cartographical survival of Atlantis is found, if at all, ot in the "first productions" but in relatively late ones, prepared after ortolan-chart makers had been doing their work for about a hundred and xty years (say from 1275 to 1435), also when Portugal had been for some me the most important agent in maritime discovery and would naturally nd to give any new insular find a Portuguese outline and a Portuguese ame. Now, the elongated rectangular form of Beccario's and Bianco's ntillia—repeated also by Pareto,[10] Roselli,[11] Benincasa,[12] and the Weimar ap,[13] once attributed to 1424 but now known to be later—appears a suggeson of Portugal; its position may fairly be described as opposite Portugal,

[1] Gustavo Uzielli: Mappamondi, carte nautiche e portolani del medioevo e dei secoli delle grandi operte marittime construiti da italiani o trovati nelle biblioteche d'Italia, Part II (pp. 280-390) of Studi Bibliografici e Biografici sulla Storia della Geografia in Italia," published on the occasion of e Second International Geographical Congress, Paris, 1875, by the Società Geografica Italiana, Rome, 75; reference on Pls. 8 and 9 (the second edition, Rome, 1882, does not contain the plates).

[2] A. E. Nordenskiöld: Periplus: An Essay on the Early History of Charts and Sailing Directions, Stockholm, 1897.

K. Kretschmer: Die Entdeckung Amerikas in ihrer Bedeutung für die Geschichte des Weltbildes, 2 vols. (text and atlas), Berlin, 1892; reference on Pl. 4.

[3] A. Magnaghi; Il mappamondo del genovese Angellinus de Dalorto (1325): Contributo alla storia lla cartografia medioevale, *Atti del Terzo Congr. Geogr. Italiano, tenuto in Firenze dal 12 al 17 Aprile, 1898*, rence, 1899, Vol. 2, pp. 506-543.

[4] A. E. Nordenskiöld, *op. cit.*, Pl. 8.

[5] Theobald Fischer: Sammlung mittelalterlicher Welt- und Seekarten italienischen Ursprungs. 1 vol. text and 17 portfolios containing photographs of maps, Venice, 1886; reference in Portfolio V (Facile del Portolano Laurenziano-Gaddiano dell' anno 1351)., Pls. 4 and 5.

[6] Jomard: Les monuments de la Géographie, ou recueil d'anciennes cartes, . . . Paris, [1854-62].

[7] G. Uzielli, *op. cit.*, Pl. 7.

[8] A. E. Nordenskiöld, *op. cit.*, Pl. 15.

[9] P. A. Jaubert (translator): Géographie d'Édrisi, traduite de l'Arabe en Français, 2 vols. (Recueil de yages et de Mémoires publié par la Société de Géographie, Vols. 5 and 6), Paris, 1836 and 1840; also later Joly and Goegi. The Pockocke and Greaves MSS. are in the Bodleian Library, Oxford.

[10] K. Kretschmer, *op. cit.*, atlas, Pl. 5.

[11] E. L. Stevenson: Portolan Charts, *Publ. of the Hispanic Soc. of Amer. No. 82*, New York, 1911.

[12] K. Kretschmer, *op. cit.*, atlas, Pl. 4.

[13] Preserved in the Grand Ducal Library of Weimar. Part showing Antillia never reproduced; writer s photograph, made in Weimar.

out beyond the Portuguese islands across a great expanse of sea; and it name Antillia has exactly or very nearly the sound of Anti-illa or Ante-illa —*illa* being the older Portuguese form of *ilha,* island, and found on many maps. Here we have a perfectly natural genesis and derivation. Why go back instead to the Greek Atlas and the ancient Atlantis tale of submergence?

Moreover, while a drowned land might leave a few jutting peaks above the surface, it would not be represented by a great insular mass like Beccario's and Bianco's Antillia. Nor could any fragment, if preserved be expected to retain the shape of the entire lost island, so as to afford corroborative evidence, such as some have thought they drew from a comparison between the map island and the description given by Plato.

The hypothesis of the identity of Atlantis and Antillia dates back nearly to the first revival of interest in the map of Bianco, 1436, and has numbered d'Avezac among its adherents, though he did not subscribe to it very confidently. But they have remained a minority. It did not convince Formaleoni,[14] nor Alexander von Humboldt,[15] who devotes an interesting passage of the "Examen Critique" to his positive dissent, nor Nordenskiöld,[16] who states roundly in his "Periplus" that all maps showing Antillia should be classed among maps relating to the New World and proceeds to put his precept into practice.

In view of these facts, it is certainly quite unwarranted to assert that Antillia of the maps represents Atlantis or that Atlantis had anything to do with naming the Antilles.

The name Antillia may be older than the special area and outline with which it was so long associated, for we seem to find it as "Atilie" or "Atilæ" in a corrupt and uncertain Latin inscription on Pizigano's above mentioned map of 1367, so well reproduced by Jomard. A picture, inverted of a huge statue accompanies it as having been set up on the shore of the island, not shown, to warn navigators against sailing farther west. The location might indicate Corvo,[17] where there was also a tradition of a statue but one rather inciting than restraining. The item is too frail to lean upon If this word be not Antillia, the name was as unknown as the great island form before the fifteenth century, so far as present information tells us If it be Antillia on Pizigano's map, then this name made afterward a mighty migration southwestward to reach the abiding-place of Beccaria's Antillia.

The latter island seems most reasonably explained by three items- the tradition recorded on Behaim's map[18] that an Iberian ship had visite

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14 Vicenzio Formaleoni: Description de deux cartes anciennes tirées de la Bibliothèque de St. Ma à Venise, pp. 91-168 of the same author's "Essai sur la marine ancienne des Vénitiens," trans. by t Chevalier d'Henin, Venice, 1788.

15 A. von Humboldt: Examen critique de l'histoire de la Géographie du Nouveau Continent, 5 vo Paris, 1836-37; references in Vol. 2, pp. 192 and 211.

16 *Op. cit.*, p. 177.

17 A. von Humboldt, *op. cit.*, Vol. 2, p. 325.

18 E. G. Ravenstein: Martin Behaim: His Life and His Globe, London, 1908.

t in 1414; the inscription on Beccario's 1435 map to the effect that Antillia ınd her consorts are newly reported islands; and the well-defined scheme of great insular land areas, constituting a remote southwestern archipelago, so confidently repeated on the maps during many years and so unlikely o occur in the first instance to any one who had no actual knowledge of he West Indies.

As to Atlantis, Plato's minute and realistic description may indicate nly the literary skill which clothes a tale with verisimilitude; but it is robable that its general drift and catastrophe embody a genuine tradiion, and this would most likely have some reality behind it sure to grow normously in the telling—a growth that might well be stimulated by the ıeed to explain the well-known impediments of the Sargasso Sea.

In fact sudden loss of insular territory has occurred in rather recent imes. According to a work on the Azores by a native of Flores,[19] an appreiable slice of that island, two miles long, simply fell off about the middle f the last century and formed temporarily a new island, and also caused a great wave which drowned two people on Corvo, six miles away. This latter sland, too, may have had its losses. Though now much the smaller of the wo, it is shown as far the larger on the maps of the fourteenth and fifteenth enturies, also as being in shape like a clover-leaf, a form which it does ıot now present. We cannot say whether this difference is due to some arly inaccuracy of report or drawing, slavishly repeated, or whether it ecords some subsidence of the island or other change reducing its area. Perhaps all these East Atlantic archipelagoes may profitably be investigated with such possibilities in view.

But at present we can only say that neither the maps nor records show ıny great loss of land and that a vast Atlantis, suddenly sunk, would be ınique in human history.

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[19] Borges F. de Henriques: A Trip to the Azores, pp. 14, Houghton & Co., 1867.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

April Meetings. The regular monthly meeting of the American Geographical Society was held on April 24 at the Engineering Societies' Building, 29 West Thirty-ninth Street. President Greenough presided. He submitted the names of 197 candidates for Fellowship, each of whom had been approved by the Council, and they were confirmed as Fellows of the Society. Thereupon Mr. Le Roy Jeffers delivered a lecture entitled "Mountaineering in North America." Mr. Jeffers exhibited a large number of views of the most famous mountains, waterfalls, and other scenic features of British Columbia and the West. An inter-monthly meeting was held on April 10, an account of which follows immediately below.

Presentation of the Cullum Geographical Medal to Major-General George W. Goethals. At an inter-monthly meeting of the Society on April 10, at the Engineering Societies' Building, 29 West Thirty-ninth Street, Major-General George W. Goethals was presented with the Cullum Geographical Medal.

President Greenough presided, and in presenting the medal spoke as follows:

"Ladies and Gentlemen, Fellows of the Society:

"It is my agreeable duty, as your representative, to ask the acceptance by our distinguished guest of an enduring memorial of appreciation of his work and genius in the completion of the great undertaking with which his name is irrevocably associated. Honours and praise have deservedly been showered upon him from many quarters, and other speakers have described, far better than I could, the physical difficulties which he has surmounted and which are familiar to you all. I desire in my few remarks to suggest some reflections on what I may term the moral triumph achieved by him in the conduct of his arduous task.

"The conception of an inter-oceanic canal took shape speedily after the Spanish occupation. In the year 1551 the Marquis de Gomara, historian of the Indies, after describing his plan for piercing the Isthmus, memorialized the King as follows: 'There are mountains, but there are also hands; give me the resolve and the task will be accomplished. If determination is not lacking, means will not fail.' Three and one half centuries had to elapse before these brave words were crystallized into action, but they breathe the spirit which found embodiment in the chief who was destined finally to conduct the enterprise to success, and whom we honor tonight. Never, I believe, has a finer example been offered of fortitude under discouragement, of devotion to duty, and of abnegation of self in directing great affairs. It seemed at times as if both nature and man were in league to enhance his difficulties, but unflinchingly and calmly he devised plans to overcome the forces of the one, and to defeat the designs of the other. Duty and service formed his sole incitement and guide in every action, and it was his rare gift to be able to animate others with his own enthusiasm in the midst of obstacles.

"I do not strain the comparison if I recall that the fame of the Father of his Country rests no less upon his power to inspire the failing ardor of his countrymen than on his ability to lead them in conflict; and that thought of his own advantage was ever forgotten in his devotion to his country. It is a pleasing thought that the attributes of Washington have found a place in the character of his compatriot and namesake, George Washington Goethals, to whom I address your felicitations.

"And now, General, on behalf of the American Geographical Society, I beg to present to you their gold medal, which seeks to record in the brief terms of its inscription your great achievement and its relation to the science to which the Society is devoted. It reads:

TO GEORGE W. GOETHALS
BUILDER OF THE PANAMA CANAL
HE FULFILLED THE ANCIENT DREAM OF GOMARA
OF A HIGHWAY BETWEEN THE ATLANTIC AND THE PACIFIC
AND THEREBY TRANSFORMED FOREVER
THE GEOGRAPHIC RELATIONS OF THE COMMERCIAL WORLD

"May I be permitted, in presenting this emblem, to add that it is accompanied by the personal good wishes of our three thousand Fellows for your long-continued health and prosperity?"

In accepting the medal General Goethals spoke of his high appreciation of the award no less on behalf of the great force of men who helped build the Panama Canal than for himself. He wished to share with all of them an honor which he accepted as their spokesman and representative. There followed a most interesting account of the construction of the canal, fully illustrated with lantern views, which showed the various methods of excavation; the special problems, with particular reference to the great slide; the dams and lock system and the mode of operation; and the new terminal facilities, ports, wharves, dry dock, and breakwaters.

Sir Ernest Shackleton's Visit to New York. The main outline of the story of Lieutenant Sir Ernest Shackleton's last expedition to the Antarctic is familiar to readers of the *Review* (Return of Shackleton from Weddell Sea, Vol. 2, 1916, pp. 54-57, with map; Rescue of the Marooned Men of Shackleton's Weddell Sea Party, *ibid.*, pp. 231-232; Rescue of the Marooned Men of Shackleton's Ross Sea Party, Vol. 3, 1917, pp. 245-246). By those who had the privilege of hearing him in Carnegie Hall on Sunday evening, April 29, no detail of that story will ever be forgotten. Sir Ernest modestly called the account of the expedition a story of failure because the original objects were not achieved; but so long as the race breeds men of courage, so long as loyalty to his pledged word is part of a gentleman's creed, this story of "failure" will stir men's hearts and kindle their deepest enthusiasm. Shackleton told his men, whom he left marooned on Elephant Island, that he would return, and he simply did that, neither stopping at the end of a third failure nor deceiving himself by the specious thought that the men must have died before the fourth relief ship could sail. All were safe; and their faith in his return will be immortalized in history by the command of Frank Wild, who on each clear day ordered: "Boys, roll up your sleeping bags; the 'boss' may come at any moment."

In this, of all times the most perilous for that civilization which it has cost the race such tragic effort to build, it is well to hold before us this latest and in many respects greatest epic of polar exploration and to take heart of the thought that the man who did not count the cost of keeping faith with comrades represents a nation allied with us in rescuing civilization from great peril.

The lecture was given under the joint auspices of the American Geographical Society and the American Museum of Natural History. It was repeated before the Geographical Society of Philadelphia on Tuesday, May 1; at Aeolian Hall, New York, Wednesday, May 2; and had been given a few days previously before the Geographic Society of Chicago. Sir Ernest also made a few informal remarks at the Explorers' Club luncheon at which he was the guest of honor on Sunday, April 29, at the Hotel Majestic, New York. He returns to England presently, where, after two weeks' rest, he will enter the war service. Twenty of his men are already at the front, where one of them was killed on his first day in the trenches.

NORTH AMERICA

The Survey of the Air over North America. A strong movement is under way to develop a survey of the air over North America and the adjoining waters. The objects are to observe and chart the irregularities of air currents, to establish aërological stations for observers not only at the earth's surface but also aloft to ten thousand feet or more, and thereby to safeguard aircraft and the lives of aviators and extend their limits of service both in time of peace and in time of war.

The National Advisory Committee for Aëronautics is fostering the movement and has the support of the Aëro Club of America and many men of high scientific standing. An Aërological Survey might become co-ordinate with the Hydrographic Office, the Coast and Geodetic Survey, and the Geological Survey. The need for better aëronautical charts is apparent to every one who is interested in the progress of flying. The *Review* will shortly publish a series of articles on the construction and use of such charts, with special reference to the development of a standard set of symbols. A bibliography of the subject and a number of illustrations will accompany one of the articles. They will deal with the two chief kinds of aëronautical charts: those designed as mere route charts for long cross-country flights and those on a large scale and showing much detail, which are constructed for intensive work like that required on a fighting front or in a densely populated region where frequent stops, as in mail or passenger service, may be necessary.

The Eradication of Malaria in the United States as a Preparedness Measure. The geography of disease has been a subject of frequent comment in the *Review*. Ward has emphasized this in "The Hygiene of the Zones" (Chapter 7 of his "Climate Con-

sidered Especially in Its Relation to Man,'' New York, 1908, pp. 178-219). A recei paper of exceptional value was read by F. L. Hoffman at the tenth annual meetin of the Southern Medical Association, November 14, 1916, and is entitled ''A Plea an a Plan for the Eradication of Malaria Throughout the Western Hemisphere'' (65 pp. Prudential Insurance Co., Newark, N. J.). Not the least among its good qualities a its copious references to the literature of land drainage, the climatic elements of enviro ments, and well-digested statistics regarding mortality and sanitation.

It is shown that malaria ranks first among the endemic diseases of the South i causing social and economic loss and in its widespread and insidious character. I warm climates especially it produces in the aggregate an enormous amount of sic ness and mortality. And though it has been largely stamped out in the North as result of the general settlement of the land and the drainage of swamps and poo there are still left important centers of development, as in the Valley of Californi where in some otherwise promising localities there is a retarded growth on account its prevalence. This is a deplorable economic waste in the light of the needs of o rapidly increasing population.

Expeditions and commissions for the study of malaria have been sent to vario geographical regions: it suffices to mention the Ross expedition to Sierra Leone, t Taylor expedition to Nigeria, and the investigation of the sanitary conditions Pará, the Panama Canal Zone, India, Dutch East Indies, and British Malaya. Thoroug going these have been and productive of conclusions now requiring transformation in government statutes and works.

In the United States the soil surveys and topographic surveys already made p mote field studies of malarial conditions and should be extended more rapidly th in the past to the end that governmental control of primary sanitation laws m become effective. Parts of the South have been mapped in an adequate way, b meteorological conditions require further investigation in spite of their seconda importance. O'Connell's studies deserve special consideration as suggesting unreali relations between malaria and meteorology.

The proposal is to improve rural sanitation; to construct rural post roads; to ca on demonstration work; to promote drainage plans and stimulate activity in educat the people to a knowledge of the habits of the *Anopheles* mosquito and the proper of quinine in prevention and cure; to search for natural enemies of mosquitoes; to accomplish these results by the widest publicity through industrial and corpor organizations, international and national congresses, state and county governments,

The most intensely malarial sections of the United States today are the Yazoo D counties of Mississippi, the river counties of Tennessee, southeastern Missouri, Arkan and Louisiana. From seven river counties of Missouri the average mortality rate for period 1911-1914 inclusive was 168.8 per 100,000 population, for Dunkin County as h as 296.7. This is higher than the rate for the corresponding period in Trinidad Tobago (218.9) and almost as high as that for Venezuela (305.6).

Progress in reducing the prevalence of the disease is most satisfactory. The mala death rate at Havana has been reduced from 49.0 per 100,000 in 1900-1904 to 2.4 100,000 in 1910-1914, or 95.1 per cent! In the Danish West Indies (now the Ameri Virgin Islands) the rate has been lowered 88.8 per cent, in Rio Janeiro, 86.5 per c and in Colombo, Ceylon, 84.9 per cent.

The Probable Growing Season for Crops in the United States. William Reed, of the Office of Farm Management, U. S. Department of Agriculture, been investigating the length of the growing season in the United States and has sented a number of new facts which are of practical use to farmers (The Proba Growing Season, *Monthly Weather Rev.*, Sept. 1916). The average number of d without frost is not all that the intelligent farmer needs or wishes to know. He ne information as to the chances of his having a longer or a shorter growing seas Then he can decide whether the risk of his losing his crop is worth taking or not. Reed has constructed three maps which are an interesting and important exten of our practical knowledge of frost conditions in relation to agriculture (*ibid.*, 122-124; see also Figs. 3 and 4 in the same author's article on ''Weather as a Busi Risk in Farming'' in the July, 1916, *Geogr. Rev.*). The first map shows the num of days without killing frost for which the chance is about 4 in 5, the chance b computed in the same manner as insurance risks are determined. If losses from f occur more frequently than once in five years, success in the crops is not likely. second map shows the dates on which the chance of killing frost falls to 1 in 10 when the chance that there will be no later spring frost becomes 9 in 10. A t map shows the probable end of the growing season. The dates are those when the ch of safety becomes less than 9 in 10.

R. DEC. WAR

A Highway along the Pacific Coast. A proposal has recently been made to conıect the harbors on the Pacific by means of a highway built along the coast and for vhich the name of "Balboa Highway" has been suggested (F. W. Harris in *Engineerng News* for March 15, 1917, p. 433). The harbors on the Pacific are isolated, espeially in the northern sections, because the foothills of the Coast Range usually reach he sea. Evidence as to the need for intercoastal communication, which affords an nteresting example of geographic response, is afforded by the practice, followed ince pioneer days along the Oregon coast, of running stage lines on the beaches, ccording to a schedule based on the nautical almanac. The growing importance in ecent years of many of these harbors, including Gray's Harbor and Willapa Bay in Vashington, Coos Bay in Oregon, and Humboldt Bay in California, strengthens the ıeed of a road which will enable communication to be easily maintained between them.

The construction of this road will mark the beginning of the industrial developnent of the region. At convenient distances from the harbors lie forests which may be nade to yield ample supplies of wood pulp. Hydro-electric power can be generated t low cost and coal is not wanting. From a military standpoint also the road will e of great value, especially in the section between Coos Bay and Eureka, on Humoldt Bay, between which points intercourse along the coast is practically barred by he Siskiyou Mountains.

Anegada, A Near Neighbor of Our New Insular Possessions. Anegada is the orthernmost of the Virgin Islands; of ancient notoriety, today it is almost forgotten. ıt intervals of weeks some boat may arrive from Tortola or Virgin Gorda, and occaionally the inhabitants carry vegetables to market in St. Thomas. The island resources re self-sufficing. The coral-derived soil, irrigated from the curious natural water holes alled "wells," is wonderfully productive; cattle thrive on the island flats, and the ea adds to the generous food supply. There is little to disturb the lotus-eating existence f the Anegadan; his sole diversion, indeed, is "a vessel on the reef." Even today his may prove a profitable excitement, but it cannot compare in this respect with the ood old times when the harbor of St. Thomas was filled with shipping and before he long arm of the law was wielded so effectively from Tortola. Then the settlers 'derived more money from shipwrecks than ever they obtained by growing provision rops and cotton, or by rearing cattle, which, together with the wood of the turpentine ree, they took to St. Thomas and other ports for sale." In the business of "wreckıg" Anegada, of course, was not unique; it has been an important economic phase ı many another minor West Indian island. But this outermost of the islands, the rst sighted on the old route from Spain, enjoyed peculiar advantages from the wrecker's oint of view. It is distinguished by its dangerous tides and currents. In two years lone 63 vessels are reported to have been wrecked on its winding reefs. The name f the island—Anegada, the Drowned—suggests another physical peculiarity. With ıe exception of an elevation of sixty feet in the southeast the island lies so low as) be literally submerged during heavy gales. Circumstances thus combine to make singularly well adapted for the other nefarious phase of sea traffic that preceded ermanent settlement and the age of the wrecker. Of all the buccaneer haunts in ıe West Indies none is more famous than Anegada, the first and last stronghold of ıese sea-rovers (Patrick Vaux: A Forgotten West Indian Island, *United Empire*, ebruary, 1917).

EUROPE

A Geographical Interpretation of Berlin. Under the title "Berlin and Its egion" Dr. H. J. Fleure recently presented before the Cities Committee of the (British) ociological Society a statement of certain fundamental geographical influences operatıg in the evolution of Berlin as a great national capital (13 pp.; Sherratt & Hughes, ondon, 1916).

The growth of the German center is in sharp contrast with that of Paris. Paris, ty on a hill "around which has blown for centuries the wind of the spirit," has long een the focus of widespread influences, especially from the sunny lands of the Mediırranean (compare the note on "The Geographical Basis of the French Spirit" in e February *Review*, p. 150). Berlin on the contrary is the center of a late-developed, ıturally unattractive plain, poor alike in material and spiritual inheritance. The rested swamp of the North German Plain fell without the sphere of Roman influence, ounded effectively by the line of the Rhine-Danube, a line roughly coincident with e southern limits of a frozen January. Even in the Middle Ages the Rhine constiıted a definite obstacle to progress eastwards, though a certain penetration into the tangled valleys" of the Southern Highlands quickened the life of the several small

independent states growing up therein. But, while these small valley centers, makin use of the metal and timber resources at their command, were carrying on a profitab trade with the Hanse towns of the Baltic and North Sea shores, the plain itself remain merely a zone of transit. Population concentrated on the seaboard and along the "fa line" which marks the topographic break between the old Southern Highlands ar the Northern Plain. The characteristic effect of such a line in the concentration human occupation is shown on the accompanying map of the German fall-line citie Of them Leipzig may be taken as a type. Today, under the transformations necess tated by a modern market, it still maintains the great fair that originated there throu the favorable location at a meeting point of routes. In medieval days perhaps th greatest interest of the plain gathered about the eastern frontier between Elbe ar Oder, held by the Teutonic knights as an outpost of Christendom. When in the seve

FIG. 1—Outline map showing the relation of cities to the German "fall-line." Scale, 1:10,000,((Redrawn from H. J. Fleure's "Berlin and Its Region.")

By "fall-line" is meant the boundary between the uplands and the plain, approximately indicated the 600-foot contour, here shown as a dotted line. The areas over 1,500 feet high are shown in black.

teenth century the sea trade of the Baltic declined and the commercial bonds acr the plain weakened and Europe was engulfed in the Thirty Years' War this milit character of the plain occupation was strengthened.

Now also began the development of east-and-west communications, a movem helped by the east-west grain of the surface, dependent on the lines of morainic hi From Holland at the western edge of the plain came important influences working i variety of ways, from the introduction of personal factors—notably the alliance of Electorate of Brandenburg with the House of Orange—to Dutch help in the constr tion of canals. To the latter is directly due the rise of Berlin: the city is essenti a route center of the plain. As a focus of national life, however, Berlin is seriou handicapped by its extreme poverty of that inheritance from the past wherein French capital is so rich. Such roots of national unity are indeed much more abund in the fall-line cities, but certain physical circumstances have militated against establishment of a fall-line capital. Amongst them may be noted the existence of "unassimilated" Bohemian block that has diverted to itself and to the Vienna ba much of the interest of the South German towns. Again, the seaboard fails to prov a focus such as the English plain possesses in London. Hamburg at one extremity developed rather under state influence from Berlin than by a natural evolution f

sheries and coastwise trade. National control centering in the plain was thus con-onted with the problem of building up a national unity upon scant bases. This it is been sought to accomplish by a policy of spiritual isolation. Political barriers ive been emphasized and the new national conscience has been cut apart from the imanizing influences of exterior contact, a policy easily carried out in a region where ate control has been essential to material success.

Switzerland, and Europe's System of Navigable Inland Waterways. Because its mountain location, Switzerland appears at first sight obliged to lie outside of the stem of European inland water routes. But this isolation is costly, and the stimulus reduce the cost of foreign merchandise has led to plans for the expansion, mainly ward the Mediterranean, of Switzerland's existing water connection with the sea. In article entitled "La position géographique de la Suisse: Étude de géographie poli-que" (*Ann. de Géogr.*, Nov. 15, 1916, pp. 413-429) Professor Henri Hauser of the niversity of Dijon develops this theme and shows how dependent economically Switzer-nd is on the Rhine route: a ton of wheat routed through Rotterdam to Bern costs only .80 francs, whereas by way of Genoa it costs 25.10 francs.

Among these plans is the proposal to connect the Rhone with the Rhine by way of viss territory—the existing canal between the two river systems, from Strassburg via e Belfort depression to the Doubs River, lying wholly within German and French risdiction—and to make of Geneva a collecting center of merchandise coming from editerranean harbors. The city has the example of Basel, which has become the ad of the whole Rhine channel from Rotterdam up. The route of the proposed water-iy is as follows: up the Rhine to the mouth of the Aar (this would involve removal the obstructions to navigation above Basel, between Rheinfelden and the Aar), up e Aar, through the Lakes of Biel and Neuchatel, and via the disused Canal d'Entre-che into the Lake of Geneva. Proceeding from Geneva on French territory, the Perte du Rhône" below that city, where the river partly disappears under limestone cks, would have to be circumvented; then the whole course of the Rhone would be ailable unobstructed to the Mediterranean. Here, on the Berre lagoon, which has ently been connected by a tunneled canal with Marseilles (see note in *Geogr. Rev.*, l. 1, 1916, p. 459) a harbor might be established especially for Swiss import trade, mewhat as Cette is now, due to the circumstances created by the war, fulfilling that nction.

A radical change in the economic life of the country would follow the creation of is waterway. At present Switzerland is dependent on Westphalian coal. The rapid velopment of its industries has outgrown the supply of power from hydraulic plants. kewise for the iron which it needs Switzerland has to rely largely on Germany. iese facts explain why the Teutonic empires have exerted such influence on Switzer-id during the war. Indeed, one-third of all Swiss imports are derived from Germany ile one-fifth of its exports are sent to that country. The construction of a waterway th an outlet to the Mediterranean, offsetting the present tendency to gravitate toward North Sea, would therefore strengthen Switzerland's political stability as a European tion, while it would enable its citizens to buy more cheaply from abroad.

Use of a Relief Model in Warfare. The value of relief models as a means of ualizing topography and geographical relations in general has recently been demon-ated on the western front. A press despatch from London dated April 15 (*New rk Times*, April 16) relates that, in preparation for the recent offensive in the ighborhood of Lens, a British officer had prepared, from aërial photographs and available information, a large-scale plaster model of Vimy Ridge which indicated ry natural feature, the trenches, railways, defenses, roads and streams, and even mine craters. The familiarity with the terrain gained from a study of the model s of immense advantage in the subsequent successful assault on this important key.

Climate and the Fall of Rome. Modern progress in science is constantly provid-new and more logical interpretations of the decline of the Roman Empire. One of se, by Professor Simkhovitch, giving soil impoverishment as the cause, was noticed the November *Review* (Vol. 2, p. 376). A recent article by Dr. Ellsworth Hunting-(Climatic Change and Agricultural Exhaustion as Elements in the Fall of Rome, rvard Univ. Quart. Journ. of Economics*, February, 1917) takes up climate as one of factors to which the decline of Roman power was due. Referring to previous dies as outlined in his "Civilization and Climate," Dr. Huntington believes that the matic record indicated by the thickness of the rings in the big trees of California equally valid for Italy. Modern research has at any rate established the correlation atmospheric pressure or temperature in widely separated parts of the earth, and it

seems safe to assume that the growth of sequoias is an index of the conditions affectin rainfall in far-away Italy for any considerable period of time.

Applying in a generalized manner the curve of the big trees to Italy, Dr. Hunting ton finds that from 450 to 250 B. C. the climate of that country was favorable t human activity, but that a change for the worse ensued in the next half century an persisted during the second century, though not without indications of improvemen Thence to the beginning of the third century of our era a period of ups and down intervened, after which aridity set in which lasted until the fall of the empire. Thi was followed by better conditions, but the seventh and eighth centuries seem to hav been very unfavorable. In comparing these periods of climatic fluctuations with th agricultural changes outlined by Professor Simkhovitch, Dr. Huntington finds that th agricultural decline coincides with arid periods.

Turning to another factor, malaria is considered. The biological decline of th Romans has been attributed by observers of standing to the prevalence of this diseas Dr. Huntington shows that stagnant pools become numerous with increasing aridity As long as precipitation is sufficiently abundant, springs flow freely in their channel With slackened activity due to shortage of water, they become loaded with mud an gravel, their channels are either filled or directed into new courses, and shallow bodie of still water are created.

Dr. Huntington is thus of the opinion that the wane of Rome's power is no attributable alone to agricultural exhaustion, as Professor Simkhovitch suggests. H regards the decline of agriculture as one of the manifestations of climatic change malaria and its biological effects being considered as other results of the same genera cause.

AFRICA

Physical Geography of Spanish Morocco. A summary of the results of the exp dition to Spanish Morocco sent out in 1913 by the Real Sociedad Española de Histori Natural and the Ministerio de Estado is given by Professor J. Dantin Cereceda in recent article (La Zone Espagnole du Maroc, *Annal. de Géogr.*, Sept. 15, 1916). Onl the Yebala (French spelling, Djebala) district, extending from the Mediterranean t the Atlantic, of which the towns of Tetuan, Ceuta, Tangier, and Larache are the fo and the lower valley of the Lucus, a short river draining into the Atlantic, were visite This district forms the western part of Spanish Morocco, which is practically c extensive with the Rif Range, a chain which forms the direct continuation across t Strait of Gibraltar of the Betic Cordillera, of which the Sierra Nevada is the mo conspicuous member. (The two ranges form a letter *U* lying on its right side, w the Strait of Gibraltar on the middle of its curved portion.) The Rif Range is distin from the Atlas ranges, from which it is separated by the depression of the Wadi Seb opening funnel-shaped to the Atlantic. The lower valley of the Lucus, above mentione is a similar depression on a smaller scale, lying to the north of the Sebu.

The climate of the district, and consequently the vegetation, is of the Mediterrane type. Three plant associations may be distinguished: the evergreen forest, in which t wild olive is the characteristic tree; the *maquis*, or dense thicket growth, a xerophyt association which best reflects the climate of the region and is characterized by t dwarf palm; and a steppe region, surprisingly rich in flowering forms in springtim when it is frequented by the Moors with their flocks.

The most fertile part of Spanish Morocco is the zone which lies between the coast dunes on the Atlantic and the plateaus forming the southwestern border of the R Range. Here occur the *tirs*, or black soils, akin to the famous *chernoziom* of southe Russia. Professor Dantin Cereceda departs from the usually accepted beliefs regardi the origin of these soils and considers them as having been formed during an earli moister climate (see also the note on "The Southwesternmost Black Soils of Europe in the December, 1916, *Review*, pp. 468-469, where reference is made to the author paper on this topic).

The Arable Lands of Egypt and Their Utilization. The great reclamati works in the Nile Valley have increased the extent of arable land in Egypt by per cent between 1898 and 1913, namely, to a total of about 13,000 square mil (33,402 square kilometers), according to a Cairo letter to *L'Économiste Français* f January 8, 1913. Almost a third of this additional surface (11,218 square kilometer has not yet been cultivated, chiefly because the fellah farmers and the large la owners have in recent years applied themselves to intensive farming, a procedu largely made possible because of the greater productivity of the soil resulting from t reclamation works. Whereas in 1898 34.5 per cent of the farm lands had been ma

o yield more than one crop per year, in 1913 this figure had risen to 46 per cent. Egypt's reserves of soil are therefore abundant and they bear promise of wealth in store for its inhabitants.

According to statistics in the same article, future development will occur mainly n Lower Egypt, where vast stretches of marshes have been reclaimed. In Upper Egypt he increase in arable land, although relatively greater, does not amount to so large n area. On the other hand the lands yielding more than one yearly crop have nearly loubled in Upper Egypt, whereas in Lower Egypt they have increased by only one-fifth. This is due to the introduction of perennial irrigation in place of the former annual operation at the time of the Nile flood.

Development of a Coalfield in Southern Nigeria. The survey of the mineral esources of Southern Nigeria undertaken by the Imperial Institute led to the discovery in 1909 of the Udi-Okwoga coalfield (*Bull. Imperial Inst.*, Vol. 14, 1916, pp. 369-378). The coalfield, named from villages at its extreme ends, is situated on the hreshold plateau of Upper Guinea, which lies back of the coastal lowland, and occupies ome 1,800 square miles northeast of Asaba on the lower Niger, where extensive beds f lignite are also known to occur. The coal is of Cretaceous age and of sub-bituminous uality. In the hands of the Public Works Department development has made good progress since the completion of the railroad from Port Harcourt to Udi, the southern imit of the district (see note on "New Port and Railroad for Nigeria" in the *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, p. 205). Exploitation is facilitated by a local abor supply above the average for a primitive country. On the other hand the local imber supply is already almost exhausted, and imports now come from Lagos.

ASIA

Typhoon Precipitation in China. A study of the distribution of precipitation n China during the typhoons of the summer of 1911 has been made by Co-Ching Chu, graduate student of meteorology in Harvard University (*Monthly Weather Rev.*, August, 1916). The most important conclusions reached are (1) that the distribution f rainfall in tropical storms is uniform when compared with that in extra-tropical yclones; (2) that the heaviest rainfall usually occurs on that part of the coast where he storm passes from sea to land; (3) that the velocity of the typhoons here investiated did not decrease as they passed from sea to land; and (4) that the heaviest recipitation usually occurred along the track. In cases, however, where the storm ent far inland, this rule did not hold. In this respect, the behavior of these tropical yclones resembled that of extra-tropical cyclones. William G. Reed, in his study of he cyclonic distribution of rainfall in the United States (*Monthly Weather Rev.*, Vol. 39, 1911, pp. 1609-1615), found that the area of heaviest precipitation usually occurred n the side nearest a considerable source of moisture. R. DEC. WARD.

Proposed American Railway in Southern China. The construction with Amerian funds of a railway is projected to tap the rich Kwangsi province in southern hina, according to information in the November, 1916, issue of the *Far Eastern Review* (pp. 217-224). The line will extend from Hengchow in Hunan province to the seaport f Yamchow on the Gulf of Tonkin. At Hengchow it will connect with the great orth-and-south trunk line through China when it is completed south to Canton beyond s present stretch, Pekin-Hankow.

At present rivers provide the only lines of travel in Kwangsi. The province is ich in natural resources. Its fertile valleys have the reputation of being the granary f Kwangtung. A part of the agricultural products, consisting of cereals, indigo, roundnuts, tobacco, cotton, aniseed, camphor and olives, are transported down the aterways to Canton. Its mineral wealth is extensive, both precious and base metals eing mined by the natives. Being relatively sparsely populated—its 5,140,000 people re distributed over 77,200 square miles—the province needs railroads badly.

When the line is completed, the present network of Chinese railways will have been xtended to the southwestern districts of the country. This part of China has been dministered with difficulty from Pekin owing to the lack of communications. The ailroad will develop new life. It will furthermore be a connecting link between the rench lines of Indo-China and the Chinese railways. As contemplated, the road will enefit Canton greatly.

POLAR REGIONS

Coal Mining Farthest North. Coal mining carried on in Spitzbergen, in nearly 0° north latitude, claims the distinction of being the most northerly of the world's

organized industries (*Commerce Repts.*, Sept. 8, 1915, and Jan. 7 and Oct. 23, 1916). Its development is receiving much attention, particularly from Norwegians, although American capital has also been extensively invested. The deposits, even in the present state of incomplete investigation, are known to be vast. It is said that the two principal beds outcropping in the fiords between Advent Bay and Green Harbor are estimated to contain over a billion tons. The coal is easily worked by lateral shafts driven into the hillsides a short distance from the shore. *Commerce Reports* for October 23, 1916, states that the Norwegian Spitzbergen syndicate had shipped more than 15,000 tons of coal to Norway since mid-August. The shipments go to Tromsö, 400 miles distant from Advent Bay.

In many respects the industry is conducted under unique conditions. No pumping is necessary in the mines, for temperatures are always below freezing point. Dust is absent, and consequently no danger of explosions is to be apprehended. Shipment is limited to the summer months, but compensation is found in the continuous light of the summer days.

Politically affairs are no less singular. Spitzbergen truly is a No Man's Land. The convention of European Powers that met in Christiania in 1914 to discuss the status of the islands adjourned without conclusion, and further progress is of course closed pending the duration of the war. So the country remains an inhabited land without government and without laws.

GEOGRAPHICAL NEWS

First Annual Meeting of the Ecological Society of America. The Ecological Society of America, whose organization was noticed in these pages (*Geogr. Rev.*, Vol. 1, 1916, p. 224), held its first annual meeting at Barnard College, New York, on December 27, 28, and 29, 1916, under the presidency of Dr. V. E. Shelford of the University of Illinois. The scientific program comprised the reading of forty-two papers and the delivery of two symposiums. The activities of the society are partially centered in investigative committees, three of which were appointed during 1916. The Committee on Climatic Conditions, of which Dr. Burton E. Livingston is chairman, held a symposium embodying the suggestions of its members as to fruitful fields and methods of investigation of climatic conditions as related to the activities of organisms. The papers read in this symposium were as follows:

Ellsworth Huntington: Climatic Optima for Human Activities; A. D. Hopkins: Latitude, Longitude, and Altitude as Factors Affecting Insect Life; D. T. MacDougal: Physiological Aspects of the Influence of Light on Organisms; V. E. Shelford: Evaporation as a Climatic Factor Affecting Animals; B. E. Livingston: The Use of Organisms as Instruments for Comparing Effective Environmental Conditions.

The Committee on Soil Temperature, of which Dr. Forrest Shreve is chairman, also organized a symposium on the importance of soil temperature in various lines of ecological work. The papers read in this were as follows: Raphael Zon: Soil Temperatures as a Factor in Forestry; Alfred E. Cameron: Relation of Soil Insects to Climatic Conditions; George P. Burns: The Effect of Natural and Artificial Shade on Soil Temperatures at Different Depths; C. C. Hamilton: The Importance of Soil Temperatures to Insects, As Indicated by Their Behavior; Forrest Shreve: The Projected Soil-Temperature Survey of the United States and Canada.

The Committee on Fresh-water Fish and Fisheries, of which Prof. A. S. Pearse is chairman, was appointed late in the year and is still under organization.

Three field trips were carried out by the society during 1916, one to the Dismal Swamp of Virginia, under the leadership of Prof. J. W. Harshberger; one to the dunes of Lake Michigan and the adjacent region, under the lead of Dr. H. C. Cowles and Dr. V. E. Shelford; and one to the Cuyamaca Mountains and Imperial Valley, California, under the guidance of Mr. Frank Stephens.

The officers elected at New York for the ensuing year are: President, Dr. Ellsworth Huntington; Vice-President, Dr. J. W. Harshberger; Secretary-Treasurer, Dr. Forrest Shreve.

Personal

Mr. William H. Babcock of Washington, D. C., a student of the history of early cartography, from whom a contribution on the problem of Atlantis is printed in the present number, was in April elected president of the Anthropological Society of Washington.

Dr. W. H. Emig of the University of Pittsburgh gave a lecture on "The Plant

Geography of the Arbuckle Mountains, Oklahoma,'' before the Botanical Society of Western Pennsylvania on February 14.

Dr. Charles R. Fettke of the Carnegie Institute of Technology gave an illustrated lecture on ''Porto Rico: Its Geology, Natural Resources, and Inhabitants'' before the section of biology and geology of the Pittsburgh Academy of Science and Art on March 20.

Miss Adelaide R. Hasse, chief of the economics division of the New York Public Library, will give a course of thirty lectures on United States public documents at the summer session of Columbia University from July 9 to August 17. The lectures of geographical interest deal with the following subjects: History of the U. S. Weather Service, July 10; M. F. Maury, July 12; History of the U. S. Coast and Geodetic Survey, July 13; D. D. Owen, July 17; U. S. Geological Surveys, July 18; Francis A. Walker, August 2; N. S. Shaler, August 7; U. S. Road Service, August 8; U. S. Interstate Commerce Commission, August 13.

The plan of the course is to acquaint the student with the personality and accomplishment of some of our great pioneers in economic and scientific government research and with the origin and development of the government bureaus in which these pioneers labored. Miss Hasse is best known to geographers by her helpful bibliography of government exploring expeditions (The Reports of Explorations Printed in the Documents of the United States Government, 90 pp., Office of Superintendent of Documents, Washington, 1899).

Professor A. J. Henry of the U. S. Weather Bureau gave a lecture before the Geographic Society of Chicago on April 27 on ''Rivers and Floods of the United States.''

Dr. Ellsworth Huntington returns to Yale University at the beginning of the next academic year to occupy the position of Research Associate in Geography, ''research associate'' being a new professorial rank established at Yale which is to be occupied by men who do little or no teaching. He intends to reside in New Haven and to give possibly one graduate course.

Dr. O. E. Jennings of the Carnegie Museum and University of Pittsburgh gave an illustrated lecture on the ''Botany of the State of Washington'' before the section of biology and geology of the Pittsburgh Academy of Science and Art on February 6. Dr. Jennings is giving a course on ecology and plant geography at the University of Pittsburgh to a class of graduate students.

Mr. A. K. Lobeck of Columbia University read a paper before the New York Academy of Sciences on April 16 entitled ''The Physiography of Porto Rico.''

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

General

STEVENS, W. E. **The organization of the British fur trade, 1760-1800.** *Mississippi Valley Hist. Rev.*, Vol. 3, 1916, No. 2, pp. 172-202.

The history of the Great Lakes region, the upper Mississippi Valley, and the Northwest during the eighteenth and the early part of the nineteenth century is to a great degree the history of the fur trade. Three periods are recognized: a French phase which came to an end when the English, after the capitulation of Montreal in 1760, took military possession of Canada; an English phase which began to yield shortly after the close of the war of 1812; and an American phase which began under the Astor company and gradually waned before the march of white settlers. The need of organization of this trade during the second period, with which the present paper deals, arose from the competition which inevitably follows the establishment of a successful line of business. The old French territorial monopolies with their exclusive trade rights had to give way when the English found means of carrying goods into the heart of the fur district through the Mohawk Valley at a low rate and were thus able to offer their goods in barter at a very much cheaper rate than the French. As competition increased the independent fur trader, who came and went as he chose, was forced to become a member of a system. It was necessary for him to know the condition of the London fur market because competition was cutting down the margin of profit. During the forty years of British sway one can follow the steps of the fur trade as it changes from a feudal type of monopoly to the monopoly of the present, the combination of many individual interests.
ROBERT M. BROWN.

—— ***International boundary from the Gulf of Georgia to the northwesternmost point of the Lake of the Woods.*** Surveyed under the direction of: for the United States, O. H. Tittmann, Superintendent, Coast and Geodetic Survey, [and] C. D. Walcott, Director U. S. Geological Survey; for His Britannic Majesty, W. F. King, Chief Astronomer of the Dominion of Canada. 1:62,500. Sheets Nos. 1-19. [State Dept.], Washington 1913.

These nineteen sheets comprise only the western third of the forty-ninth parallel boundary between Canada and the United States, i. e., the section west of the summit of the Rocky Mountains (114° W.). The complete survey will comprise 59 sheets. The field work on the present sheets was done in 1901-07, mainly by topographers of the U. S. Geological Survey (by which bureau the maps are engraved and printed) and of the Topographical Surveys Branch of the Canadian Department of the Interior. This survey replaces the old survey of 1857-61 (see the article by Dr. Klotz in the present number and the index map of both series on p. 384). The re-survey of the remaining two-thirds of the boundary is being carried on at present; when published, its maps will replace the 24 sheets, 1:126,720, of the survey of 1872-76. On the present sheets relief is shown in brown contours (interval, 100 feet), drainage in blue, culture and names in black, and woods in green symbols—all in the U. S. Geological Survey's best manner.

CANADA

General

HEATON, ERNEST. **Heaton's annual: The commercial handbook of Canada and Board of Trades register, twelfth year, 1916.** 506 pp. Ontario, 1916. $1.00. 7½ x 5.

LEAVITT, CLYDE, C. D. HOWE, AND J. H. WHITE, comps. **Forest protection in Canada, 1913-1914.** xiv and 317 pp.; maps, diagrs. ills., index. Commission of Conservation, Toronto, 1915. [Includes a section by R. E. Benedict on the forest regions o

British Columbia, with colored map, 1:1,300,000, and one by J. H. White on forest conditions in various parts of the Dominion.]

—— Levelling operations, Report on, from their inauguration in year 1908 to October 31st, 1914, with a summary of the results. 364 pp.; map, ills., index. Dept. of the Interior, Ottawa, 1916.

MacKay, A. H. Bibliography of Canadian botany for the year 1914. *Trans. Roy. Soc. of Canada,* Ser. 3, Vol. 9, 1915-16, pp. 251-261.

Malcolm, Wyatt. Bibliography of Canadian geology for the year 1914. *Trans. Roy. Soc. of Canada,* Ser. 3, Vol. 9, 1915-16, pp. 279-305.

Patterson, H. J. Upper air investigation in Canada. Part 1: Observations by registering balloons. 127 pp.; diagrs., ills. *Meteorol. Service of Canada* [*Publ.*] *51.* Toronto, 1915.

Porter, J. B., R. J. Durley, T. C. Denis, and Edgar Stansfield. Recherches sur les charbons du Canada au point de vue de leurs qualités économiques. Maps, diagrs., ills., indexes. Vol. I: xiv and 275 pp.; Vol. II: xiii and 204 pp.; Vol. III: 172 pp.; Vol. IV: iv and 424 pp. Division des Mines, Ottawa, 1914.

Prince, E. E. The herring fishery of Canada: An account of recent scientific researches on the Atlantic coast. *Proc. at a Meeting of the Committee on Fisheries, Game, and Fur-bearing Animals held Nov. 1 and 2, 1915,* pp. 37-46. Commission of Conservation, Toronto, 1916.

Prince, E. E. Unutilized fisheries resources of Canada. Diagrs., ills. *Proc. at a Meeting of the Committee on Fisheries, Game, and Fur-bearing Animals held Nov. 1 and 2, 1915,* pp. 47-64. Commission of Conservation, Toronto, 1916.

Reid, F. B. Precise levelling. Map. *Publs. Dominion Observatory,* Vol. 3, 1916, No. 6, pp. 139-217. Dept. of the Interior, Ottawa.

Reinecke, L. Road material surveys in 1914. xv and 244 pp.; maps, diagrs., ills., index, bibliogr. *Geol. Survey of Canada Memoir 85: Geol. Series No. 71.* Ottawa, 1916.

Stupart, Frederic. Monthly record of meteorological observations in the Dominion of Canada, and the colonies of Bermuda and Newfoundland, 1916: (1) March, (2) April, (3) May, (4) June. 68 pp., and maps, in each. Meteorol. Service of Canada, Toronto, 1916.

Stupart, R. F. Monthly record of meteorological observations in the Dominion of Canada, and the colonies of Bermuda and Newfoundland. Jan., 1916. 75 pp. Dept. of Marine and Fisheries, Toronto, 1916.

Stupart, R. F. Monthly weather Review: October, 1915. (Vol. 39, No. 10). Pp. 210-233; map. Meteorol. Service of Canada, Toronto.

Stupart, R. F. Report of the Meteorological Service of Canada for the year ended December 31, 1913. xv and 605 pp.; diagrs. Meteorol. Service of Canada, Toronto, 1916.

Stupart, R. W. [i. e. R. F.], and R. W. Mills. Meteorology in relation to agriculture in Canada. *Monthly Bull. of Agric. Intelligence and Plant Diseases,* Vol. 7, 1916, No. 2, pp. 177-179. Internatl. Inst. of Agric., Rome.

Sulte, Benjamin. L'histoire écrite du Canada avant 1672. *Bull. de la Soc. de Géogr. de Québec,* Vol. 10, 1916, No. 3, pp. 131-133. [A short bibliography.]

Tyrrell, J. B. Pre-Cambrian goldfields of central Canada. Diagr., ills. *Trans. Roy. Soc. of Canada,* Ser. 3, Vol. 9, 1915-16, pp. 89-118.

Walker, E. M. Bibliography of Canadian zoology for the year 1914. *Trans. Roy. Soc. of Canada,* Ser. 3, Vol. 9, 1915-16, pp. 307-318.

Waugh, F. W. Iroquois foods and food preparation. xii and 235 pp.; ills., bibliogr. *Geol. Survey of Canada Memoir 86: Anthropol. Series No. 12.* Ottawa, 1916. ["One of the outstanding features of Iroquois material culture was their aptitude for agriculture." A discussion of the methods employed and the customs involved forms the first part of the report.]

White, James. Dictionary of altitudes in the Dominion of Canada (second edition). xii and 251 pp. Commission of Conservation, Ottawa, 1916. [New edition, greatly enlarged, of the earlier (1903) valuable compendium by the same author. Like it, it is supplementary to a volume entitled "Altitudes in the Dominion of Canada" (see below) in which the elevations are grouped along main lines of communication or in other regional sequence, while in the present volume they are arranged alphabetically

within each province or territory. Unlike the first edition, it is not accompanied b a relief map of North America.]

White, James, assisted by G. H. Ferguson. **Altitudes in the Dominion of Canad (second edition).** xxiv and 603 pp.; maps, diagrs., index. Commission of Conserva tion, Ottawa, 1915.

Williamson, F. H. H. **Game preservation in Dominion parks.** Ills. *Proc. at Meeting of the Committee on Fisheries, Game, and Fur-bearing Animals held Nov. 1 an 2, 1915,* pp. 125-140. Toronto, 1916.

Alberta, Saskatchewan, Manitoba

Alcock, F. J. **Lower Churchill River region, Manitoba.** *Summary Rept. Geo Survey of Canada for 1915,* pp. 133-136. Ottawa, 1916. [See also the author's artic on the Churchill River in the December *Review.*]

Allan, J. A. **Simpson Pass to Kananaskis, Rocky Mountains Park, Albert** Bibliogr. *Summary Rept. Geol. Survey of Canada for 1915,* pp. 100-102. Ottawa, 191

—— **Athabaska River country, The.** 35 pp.; map, ills. Railway Lands Branc Dept. of the Interior, [Ottawa], 1916. [Revised edition of portions of "The Unexploit West" compiled by E. J. Chambers.]

Auld, F. H. **Eighth annual report of the Secretary of Statistics, 1914.** 60 pp map, bibliogr. index. Dept. of Agric., Province of Saskatchewan, Regina, 1915. [I cludes crop statistics and meteorological data.]

Bruce, E. L. **Amisk-Athapapuskow lake area, northern Saskatchewan an northern Manitoba.** *Summary Rept. Geol. Survey of Canada for 1915,* pp. 126-13 Ottawa, 1916.

DeLand, C. E. **The Verendrye explorations and discoveries.** Maps, ill *South Dakota Hist. Colls.,* Vol. 7, 1914, pp. 99-222. State Dept. of History, Pierre, S.

Dowling, D. B. **The formation of the Great Plains of northwestern Canad** *Ottawa Naturalist,* Vol. 30, 1916, No. 1, pp. 11-14.

Dowling, D. B. **Water supply, southeastern Alberta.** Map, diagr., bibliog *Summary Rept. Geol. Survey of Canada for 1915,* pp. 102-112. Ottawa, 1916.

Drake, E. F., and F. H. Peters. **Reports on irrigation for the year 1915.** pp.; index. *Ann. Rept., Dept. of the Interior, 1915,* Part. 7. Ottawa, 1916.

Gwillim, J. C. **Notes of a northwestern trail.** *Queen's Quart.,* Vol. 23, 19 No. 1, pp. 9-15. Kingston.

—— **Irrigation surveys and inspections, 1915, Report on.** 72 pp.; maps, diagr ills. Irrigation Branch, Dept. of the Interior, Ottawa, 1916. [Alberta.]

McGrath, P. T. **Progress of the Hudson Bay Railroad.** Map. *Amer. Revie of Reviews,* Vol. 54, 1916, No. 5, pp. 538-541.

McInness, William. **Les bassins des rivières Nelson et Churchill.** *Bull. la Soc. de Géogr. de Québec,* Vol. 10, 1916, No. 4, pp. 209-213.

—— **Manitoba, Saskatchewan and Northern and Southern Alberta, Suppl ment to homestead maps of, containing synopsis of regulations governing t granting of homesteads, purchased homesteads, pre-emptions, mineral right grazing leases and timber berths, also statistical information relating to weste Canada, 1916.** 13 pp.; diagrs. Railway Lands Branch, Dept. of the Interior, Ottaw

Martin, Chester. **The Hudson's Bay Company's monopoly of the fur tra at the Red River Settlement.** *Proc. Mississippi Valley Hist. Assoc. for the Y 1913-14* (Vol. 7), pp. 254-265. Torch Press, Cedar Rapids, Ia., 1914.

—— **Peace River country, The.** 47 pp.; map, ills. Dept. of the Interi [Ottawa], 1916.

Rindsfoos, C. S. **A river of mud.** *Scientific American,* Vol. 114, 1916, No. (May 27), p. 553. [Note on an occurrence at the head of Rock Creek in the Canadi Rockies determined by sextant as located in 53° 29′ N. and 118° 35′ W., probably ide tical with Miss Jobe's "Rock Slide Creek"; cf. map facing p. 494, *Bull. Amer. Geo Soc.,* Vol. 47, 1915.]

Ryder, F. M. **Canada: Prairie Provinces.** 14 pp. *Suppl. to Commerce Rep* Ann. Series, 1916, No. 23c. Bur. of Foreign and Domestic Commerce, Dept. of Co merce, Washington, D. C.

Sauder, P. M., G. H. Whyte, and G. R. Elliott. Report of progress of stream measurements (hydrometric surveys) for the calendar year 1914. 508 pp.; diagrs., ills., index. Irrigation Branch, Dept. of the Interior, Ottawa, 1915.

Stewart, J. S. The disturbed belt of southwestern Alberta. Bibliogr. *Summary Rept. Geol. Survey of Canada for 1915*, pp. 112-120. Ottawa, 1916.

—— Survey Branch of the Department of Lands, Province of British Columbia, Report of the, for the year ending December 31, 1915. pp. 53-170. Victoria, B. C., 1916. [Pagination from the *Rept. of the Minister of Lands, 1915.*]

Wallace, R. C. The history of the salt industry in western Canada. *Proc. Mississippi Valley Hist. Assoc. for the Year 1913-14* (Vol. 7), pp. 277-285. Torch Press, Cedar Rapids, Ia., 1914.

—— Western Canada Irrigation Association, Report of the proceedings of the Ninth Annual Convention of the, held at Bassano, Alberta, November 23, 24, and 25, 1915. 249 pp.; ills. Irrigation Branch, Dept. of the Interior, Ottawa, 1916.

—— *Alberta, Cereal map of, showing acreage under crop in each township in wheat, barley, and flax.* 3d ed. 1:792,000. Railway Lands Branch, Dept. of the Interior, Ottawa, 1914.

—— *Alberta, Northern—Southern—showing disposition of lands . . . corrected to Jan. 1, 1916.* 1:792,000. Railway Lands Branch, Dept. of the Interior, Ottawa, 1916.

—— *Alberta, Province of; Grande Prairie, Peace River, and Grouard land districts. Showing number of quarter sections in each township available for homestead entry.* 1 in. to 35 mi. (1:2,217,600). Railway Lands Branch, Dept. of Interior, Ottawa, 1916.

—— (1) *Birch Hills,* (2) *Blackfoot,* (3) *Simonette, Alberta,* (4) *Limestone River,* (5) *Riding Mountain, Manitoba, sheets. [Sectional map of Canada, Nos. 565, 115, 362, 524, 121.]* 1:190,080. Topographical Surveys Branch, Dept. of the Interior, Ottawa, 1915.

—— (1) *Heart River,* (2) *Sullivan Lake,* (3) *Victoria, Alberta, sheets. [Sectional map of Canada, Nos. 513, 216, 365.]* 1:380,160. Topographical Surveys Branch, Dept. of the Interior, Ottawa, 1914, 1913, 1912.

—— *Manitoba, Map showing disposition of lands.* Corrected to Jan. 1, 1916. 1 in. to 12.5 mi. (1:792,000). Dept. of Interior, Railway Lands Branch, Ottawa, 1916.

—— *Manitoba, Saskatchewan, and Alberta, Map showing branches of chartered banks in.* 2d ed. 1:584,000. Railway Lands Branch, Dept. of the Interior, Ottawa, 1914.

—— (1) *Pasquia,* (2) *Qu'appelle, Saskatchewan, sheets. [Sectional map of Canada, Nos. 270, 120.]* 1:190,080. Topographical Surveys Branch, Dept. of the Interior, Ottawa, 1915.

—— *Regina, Saskatchewan, sheet. [Sectional map of Canada, No. 119.]* 1:380,160. Topographical Surveys Branch, Dept. of the Interior, Ottawa, 1915.

—— *Saskatchewan, Map showing disposition of lands.* Corrected to Jan. 1, 1916. 1 in. to 12.5 mi. (1:792,000). Railway Lands Branch, Dept. of Interior, Ottawa, 1916.

United States

South Atlantic States

Harper, R. M. Geography and vegetation of northern Florida. Introduction by E. H. Sellards. Map, ills., index, bibliogr. *Sixth Ann. Rept. of the Florida State Geol. Survey*, pp. 163-437. Tallahassee, 1914.

The region treated in this report embraces that part of Florida which lies north of the southern boundaries of Lafayette, Alachua, Putnam, and St. Johns Counties, an area of about 22,600 square miles (see map in the Nov., 1916, *Review*, Vol. 2, p. 363). Within this territory, according to the nature of the soil and topography, the prevalence of lakes and streams, etc., twenty natural geographical divisions are distinguishable. These various regions are described in more or less detail with reference to their geology and soils, topography and hydrography, vegetation, and economic features. As the work of a plant geographer, special interest attaches to the author's observations regarding the vegetation.

As the author remarks, native vegetation is probably the most sensitive indicator of geographical conditions that can be found. In the area under consideration the climate is essentially the same throughout, so that the diversity of vegetation is due largely to differences in soil and topography. Many attempts have been made by various investigators to correlate vegetation with soil, but few general principles, capable of world-wide application, have as yet been deduced. This fact, in Harper's opinion,

may be attributed to the general tendency to study vegetation qualitatively and tax nomically instead of quantitatively and morphologically; in other words, to the attem on the part of investigators to connect environmental conditions with the presence absence of certain species, regardless of their relative abundance and structural ada tions. A much better way, it is urged, of correlating vegetation with soil is to determi first the relative abundance of the different species in a given area, and then to gro together all those that have some character in common, such as trees, vines, evergreen or plants belonging to some given family, and see what proportion they make of t total.

Briefly stated, Harper's scheme for the quantitative analysis of vegetation is follows. In traveling through a region repeated lists are made of all the wild plan observed, with notes as to their relative abundance. In this way the largest and mo abundant plants are likely to be noted oftenest, which, in the author's opinion, is ju what is wanted in a quantitative study. In analyzing these field notes, first of all count is made of the number of times each species has been listed. The figures th obtained are then modified with reference to the relative abundance of the vario plants; figures for a plant noted as abundant are multiplied by 3, rarities are dis garded entirely, etc. Finally, allowance is made for differences in size or bulk; t average forest tree being taken as unity, figures for shrubs are divided by 100, for her by 1,000, etc. On a basis of the figures obtained in this way the bulk percentage of ea plant or group of plants in the vegetation as a whole is calculated.

In the present report the vegetation is discussed quantitatively throughout. F each region a list is given of all except the rarer wild plants observed. These are fi grouped according to growth form, and within these groups the species are listed nearly as possible in the order of their quantitative abundance. Preceding the name each species ordinarily is the percentage figure determined by the method above ou lined. In summarizing his results, special stress is laid on the percentage of eve greens, *Ericaceae*, and *Leguminosae*. According to Harper, abundance of evergree appears to be correlated with soils poor in potassium, abundance of *Ericaceae* wi soils poor in calcium or potassium, and abundance of *Leguminosae* with relatively d soils poor in nitrogen.

Harper's scheme for interpreting the facts of plant distribution in terms geography is worthy of careful consideration at the hands of phytogeographers. The can be little doubt that failure to take into account the quantitative relations of t vegetation may lead to entirely erroneous conclusions. It is conceivable, for examp that two neighboring regions, quite distinct geographically, may have essentially id tical floras but that the geographical dissimilarity may be clearly revealed by the diffe ent quantitative development of various elements in the vegetation. In the opinion the reviewer, failure to take account of quantity is the chief weakness of Raunkiae application of "life-forms" to plant geography (see review in *Journal of Ecolo* Vol. 1, 1913, pp. 16-26). Harper's method also seems to have certain defects. Chi of these, from the standpoint of an ecologist, is the way in which herbs and shrubs a lumped together with trees and gauged by the same bulk criterion. This method treatment may be satisfactory for making timber surveys, but for the purposes of phytogeographical survey it leaves much to be desired. GEORGE E. NICHOLS.

SPAULDING, ARTHUR W. **The men of the mountains: The story of the Southe mountaineer and his kin of the Piedmont; with an account of some of t agencies of progress among them.** Introduction by P. P. Claxton, U. S. Co missioner of Education. iv and 320 pp.; map, ills. Southern Publishing Asso ation, Nashville, 1915. $1.00. 9 x 6.

The introductory chapters, which give a broad survey of the Appalachian highlan south of the Potomac, appeal directly to geographers. In the sketch of early explo tions, settlements, activities of religious sects, and military expeditions, the interacti of land and people is emphasized. Illiterate inhabitants of infertile mountain tops a cultured citizens of the Appalachian Valley are shown to be descended from the sa pioneer stock. Contrasts between them are ascribed to geographical and econon causes.

The rest of the book, interesting to teacher and social worker, describes educatio institutions within the region.

None of the material is new and there are trifling errors in physiographic nomenc ture, but Mr. Spaulding successfully demonstrates by a geographical background t need of schools adapted to local conditions. MARY VERHOEFF.

ALVORD. C. W. **Virginia and the west: An interpretation.** *Mississippi Vall Hist. Rev.*, Vol. 3, 1916, No. 1, pp. 19-38.

Brantly, J. E. **A report on the limestones and marls of the coastal plain of** **Georgia.** x and 300 pp.; maps, diagrs., ills., index. *Geol. Survey of Georgia Bull. No. 21.* Atlanta, 1916. [With a 43-page section on the physiography, structure, and geology of the Georgia coastal plain (incorrectly referred to as "North Georgia" in he table of contents), illustrated by a geologic map, 1:1,000,000.]

Carter, W. T., Jr., and J. P. D. Hull. **Soil survey of Montgomery County, Maryland.** 39 pp.; maps, ills. Bur. of Soils, U. S. Dept. of Agric., Washington, D. C., 1916.

—— **Florida: Standard guide.** 86 pp.; maps, ills. Foster & Reynolds Co., St. Augustine, 1916. 10 x 7.

Forgo, William. **Southern Atlantic States and Washington, D. C.** (Forgo "See America" Guides, No. 4.) 96 pp.; diagrs., ills., index. Robert M. McBride & Co., New York, [1915]. 40 cents. 8 x 4½.

Grimsley, G. P. **Jefferson, Berkeley, and Morgan Counties.** xxvi and 644 pp.; maps, diagrs., ills. *West Virginia Geol. Survey County Repts.*, Morgantown, 1916. [The geological report is preceded by a summary description of the history, physiography, and climate of these eastern Panhandle counties.]

—— **Key West, Florida, The new and greater, told in picture and story.** 44 pp.; map, ills. Key West Board of Trade, Publ. by J. A. Willis, Key West, [1915?]. ½ x 5½.

Krebs, C. E., and D. D. Teets, Jr. **Raleigh County and the western portions of Mercer and Summers Counties.** With: **Notes on the paleontology of Raleigh, Wyoming, McDowell and adjacent counties.** By W. A. Price. xx and 778 pp.; maps, diagrs., ills., index. *West Virginia Geol. Survey County Repts.* Wheeling, 1916. [Including as Part I short sections on the historical and industrial development and the physiography of the counties.]

Latimer, W. J. **Soil survey of McDowell and Wyoming Counties, West Virginia.** 32 pp.; maps. Bur. of Soils, U. S. Dept. of Agric., Washington, D. C., 1916.

Latimer, W. J. **Soil survey of Raleigh County, West Virginia.** 34 pp.; maps. Bur. of Soils, U. S. Dept. of Agric., Washington, D. C., 1916.

Maigne, C. M. **How the shrimp industry saved Fernandina.** Ills. *Scientific American,* July 8, Vol. 115, 1916, p. 35. [Fernandina is a small city of Florida whose trade in lumber and naval stores was curtailed on the outbreak of war.]

Rehn, J. A. G., and Morgan Hebard. **Studies in the Dermaptera and Orthoptera of the Coastal Plain and Piedmont region of the southeastern United States.** Maps, diagrs., ills. *Proc. Acad. Nat. Sci. of Philadelphia,* Vol. 68, 1916, Part 2, pp. -314. [The physiographic divisions found correlated with the distribution of species in the South Atlantic States are High Appalachian summits; Lower summits and Valleys of the Appalachian Uplift; Piedmont; Coastal Plain embracing Upper and Lower divisions; Maritime and Estuarine region.]

Robinson, M. P. **Virginia counties: Those resulting from Virginia legislation.** 3 pp.; maps, index, bibliogr. *Bull. Virginia State Library,* Vol. 9, 1916. Nos. 1-3. Richmond. [Including a bibliography and set of maps showing progress of settlement in Virginia.]

Schoff, W. H. **Chesapeake Bay and tributaries.** Ills. *Commerc. America,* Vol. , 1916, No. 12, pp. 15, 17, 19, and 21.

Sellard, E. S. **Mineral industries of Florida during 1915.** *Florida State Geol. Survey, Eighth Ann. Rept.*, pp. 19-37. Tallahassee, 1916.

Swem, E. G. **A bibliography of Virginia, Part 1: Containing the titles of books in the Virginia State Library which relate to Virginia and Virginians, the titles of those books written by Virginians, and of those printed in Virginia.** Index. *Bull. Virginia State Library,* Vol. 8, 1915, No. 24, pp. 35-767. Richmond, 1916.

Willey, D. A. **Reclaiming the Everglades of Florida.** Ills. *Scientific American,* Vol. 115, 1916, pp. 258-259.

—— ***District of Columbia, Map of the permanent system of highways.*** 1:12,000. Engineer Commissioner, Washington, D. C., 1914.

—— ***Florida, Map of the Everglades drainage district of.*** 1:380,000. Chief Drainage Engineer, Tallahassee, 1915.

—— ***Florida, New sectional map of.*** 1:633,600. Florida Dept. of Agric., Tallahassee, 1916.

—— *Florida, State of.* 1:500,000. U. S. Geological Survey, Washington, 1916.

—— *Henlopen, Cape, and the Delaware Breakwater.* *U. S. Coast and Geodetic S vey Chart No. 379.* Washington, D. C., August, 1916.

Hermann, Augustin. *Virginia and Maryland, as it is planted and inhabited t present year 1670. Surveyed and exactly drawne by the only labor and endeavour Augustin Hermann.* [Photo-facsimile.] 1 in. to 7.5 mi. (1:475,000). [Also book c tion with text, W. H. Lowdermilk & Co., Washington, D. C., 1911.]

—— *Maryland and Delaware, The Rand McNally new commercial atlas map* [with text and inset of Baltimore and environs]. 1:6,000,000. Rand McNally (Chicago, 1916.

—— *Portsmouth Island, North Carolina, to Beaufort, including Cape Lookout Sho* 1:80,000. *U. S. Coast and Geodetic Survey Chart No. 1233.* Washington, D. C., 1916

—— *Talking Rock, Georgia, sheet.* [*Topographic map of the United Stat* 1:62,500. U. S. Geological Survey, Washington, D. C., 1916.

—— *Tybee Roads. Savannah River and Wassaw Sound, Georgia.* 1:40,000. *U. Coast and Geodetic Survey Chart No. 440.* Washington, D. C., August, 1916.

—— *Virginia, The Rand McNally new commercial atlas map of* [with te 1:887,040. Rand McNally Co., Chicago, 1916.

North-Central States

Sardeson, F. W. **Geologic atlas of the United States: Minneapolis-St. Paul fo Minnesota.** 14 pp.; maps, ills. *U. S. Geol. Survey Geol. Folio No. 201.* W ington, D. C., 1916.

This folio will be of great educational value locally to the inhabitants of the a numbering some 500,000, and, in a more general way, to a wider circle. Two pages given to introduction, with an index map showing the location of the four fifteen-mi quadrangles which are embraced in the folio, another map showing the geographic p inces, and a third showing the bed rock formations of Minnesota and the adja region. These, with the text, give a proper setting for the detailed descriptions w follow.

Most of the area is deeply covered with glacial drift. The exposed rock formati are of Ordovician age. Three drift sheets are discriminated: Kansan, Early Wiscon and Late Wisconsin. Later than these are the terrace gravels, dune sands, and re deposits. The curvature of the ice motion in the western lobe of the Late Wisco glacier is such that over the area shown by the folio the motion was from the south An interesting discussion is given of the origin and duration of St. Anthony Falls. lowing Winchell's determinations it is concluded that the falls have been in exist more than 12,000 years. Building materials and water resources are the impor economic assets of a geologic nature.

The maps and illustrations are excellent. It was wisely decided as in other re folios to publish all maps on the 1:62,500 scale instead of condensing the four quadran into one sheet on half this scale. The scale of 1:62,500 enables the maps to be readily on the ground and by those but little experienced in reading and interpre maps. They show great areas of dune sand and marsh land to the north of the t cities, gently hilly country interspersed with lakes on the south. The pages of illus tions serve to make the folio more attractive and the descriptions more real. It w seem that large use should be made of this publication in the high school department tho public school system of Minnesota. Joseph Barrell.

Alway, F. J. **Soil maps of Minnesota.** *Journ. of Geogr.*, Vol. 14, 1915-16, N pp. 205-206.

Cady, Le Roy. **Fruit growing in Minnesota.** *Journ. of Geogr.*, Vol. 14, 1915 No. 6, pp. 211-214.

Cheyney, E. G. **The development of the lumber industry in Minnesota.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 6, pp. 189-195.

Coffey, G. N., John Woodard, and J. M. Snyder. **Soil survey of Trum County, Ohio.** 53 pp.; maps. Bur. of Soils, U. S. Dept. of Agric., Washington, D. 1916.

Colby, C. C. **The driftless area of Minnesota, a geographic unit.** *Journ Geogr.*, Vol. 14, 1915-16, No. 6, pp. 165-167.

Davis, L. V., and M. E. Sar. **Soil survey of Lee County, Iowa.** 36 pp.; m ills. Bur. of Soils, U. S. Dept. of Agric., Washington, D. C., 1916.

Durand, E. D. **Manufactures in Minnesota.** *Journ. of Geogr.*, Vol. 14, 1915-16, o. 6, pp. 218-222.

Dustin, Fred. **Saginaw County as a center of aboriginal population.** *Michi-n Hist. Collections*, Vol. 39, pp. 251-260. Lansing, 1915.

Emmons, W. H. **The iron ores of Minnesota.** Map. *Journ. of Geogr.*, Vol. 14, 15-16, No. 6, pp. 177-182.

Everly, L. L. **Minnesota cities: St. Paul.** *Journ. of Geogr.*, Vol. 14, 1915-16, o. 6, pp. 227-229.

Grout, F. F. **The clays of Minnesota.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 6, . 185-187.

—— **Hot Springs of Arkansas, General information regarding the.** 10 pp.; ıp. Dept. of the Interior, Washington, D. C., 1916.

Huff, C. E. **Minnesota cities: Minneapolis.** *Journ. of Geogr.*, Vol. 14, 1915-16,). 6, pp. 223-226.

Jenks, W. L. **The Michael Shoemaker collection of maps.** *Michigan Hist. llections*, Vol. 39, pp. 297-300. Lansing, 1915. [''Early maps relating to the Great kes region.'']

Johnston, A. W. **The physical geography of Minnesota.** *Journ. of Geogr.*, l. 14, 1915-16, No. 6, pp. 161-165.

Leonard, A. G. **The pre-Wisconsin drift of North Dakota.** Map, ills. *Journ. Geol.*, Vol. 24, 1916, No. 6, pp. 521-532.

Miller, G. J. **Agriculture in Minnesota.** Diagrs. *Journ. of Geogr.*, Vol. 14, 15-16, No. 6, pp. 196-201.

—— **Minnesota number of the *Journal of Geography*.** Maps, diagrs. Vol. 14, 16, No. 6 (pp. 161-244). [The entire number is devoted to a series of papers dis-ssing various features of Minnesota geography, which are individually listed in this tion. See the item on Geographic Controls in the Development of Minnesota in the ıe, 1916, *Review* (Vol. 1, p. 456).]

Mooney, C. N., H. G. Lewis, A. F. Head, and C. W. Shiffler. **Soil survey of rtage County, Ohio.** 44 pp.; maps. Bur. of Soils, U. S. Dept. of Agric., Wash-ton, D. C., 1916.

Posey, C. J. **Geographic influences in the exploration and early development Minnesota.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 6, pp. 214-217.

Scarborough, R. J. **The lesser cities of Minnesota.** *Journ. of Geogr.*, Vol. 14, 5-16, No. 6, pp. 233-236.

Smith, S. L. **Pre-historic and modern copper mines of Lake Superior.** *Mich-n Hist. Collections*, Vol. 39, pp. 137-151. Lansing, 1915.

Soper, E. K. **Peat in Minnesota.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 6, 182-185.

Steere, J. H. **The upper peninsula: A sketch.** *Michigan Hist. Collections*, . 39, pp. 235-247. Lansing, 1915.

Townsend, C. McD. **The currents of Lake Michigan and their influence on climate of the neighboring states.** Map. *Journ. Western Soc. of Engineers*, . 21, 1916, No. 4, pp. 293-309. [The author was a member of the board appointed nvestigate lake problems relating to the proposed waterway from Lockport, Ill., to mouth of the Illinois River. In this capacity he instituted a series of observations the directions of the wind and the currents of the lake and on the temperatures of and water. His conclusions in respect of the lake currents are contrary to those lished by the Weather Bureau as a result of their bottle-drift experiments, carried during the summers of 1892-94. The Weather Bureau's chart indicates a main ent flowing southward along the west shore to swing northward along the east e. Colonel Townsend's conclusion is that the currents vary with the wind and no permanently defined direction.]

Tryon, F. G. **The water resources of Minnesota.** *Journ. of Geogr.*, Vol. 14, 5-16, No. 6, pp. 174-177.

Vanatta, E. S., and E. W. Knobel. **Soil survey of Harrison County, Missouri.** p.; maps. Bur. of Soils, U. S. Dept. of Agric., Washington, D. C., 1916.

Van Cleef, Eugene. **The climate of Minnesota.** Maps. *Journ. of Geogr.*, Vol. 1915-16, No. 6, pp. 168-174.

Van Cleef, Eugene. **Minnesota cities: Duluth and the Range towns.** *Jou of Geogr.,* Vol. 14, 1915-16, No. 6, pp. 230-233.

Visher, S. S. **Notes on the geography of the Red River Valley.** *Journ. Geogr.,* Vol. 14, 1915-16, No. 6, pp. 202-205.

EUROPE

Russia

Child, R. W. **Potential Russia.** 221 pp. E. P. Dutton and Company, New Y 1916. $1.50. 7½ x 5.

Part of the material used in this work has appeared in the magazines, includ *Collier's,* which commissioned Mr. Child to go to Russia. The title expresses its un lying thought. Russia is studied with a view to determine, not what she has actu accomplished, but her possibilities for the future. Without predicting the revolut in fact denying its probability, the author speaks of the promise of a new social era Russia, the beginning of a development of a vast human, material, and spiritual resou To depict the unit that makes up the Russian army, the story of an individual is tra from his infancy in a half-thatched peasant home, through his youth as a clean-liv sturdy farmer who learned to read as an accomplishment to please his sweetheart, the war came. Soon after, he leaves his home for the first time, drawn into the ar In Petrograd he receives his training and in his new uniform he makes a magnific looking soldier. With the order to the front he first sees war. The ammunit the men should have had was lying in the snow thirty miles south of Archangel, knowing nothing of that, Maxim and his comrades charge the German machine g in an ecstasy of devotion, then pitch face forward into a swamp. The muzhik, one millions, has given his all for Russia.

A terrible story is told of the flight of the refugees from the western front, t number estimated at between eight and fourteen millions. Thousands of children w lost or perished of hunger and cold on the roads. Without knowing where to go refugees instinctively headed towards the railroads and the cities. Moscow and Pe grad received each a million, but the greatest number were lost struggling over plain.

In speaking of Russian reverses and internal troubles the author calls the cou a great resilient lump. "It may not be difficult to stick a thumb into Russia, but i tiresome trying to keep it there." The fact is often reiterated that Russia is a of 125,000,000 peasants, of whom the larger part cannot read or write. To know true Russian one must go to the villages. The impression that the bureaucracy constantly opposed elementary education is corrected. Lack of money and poor man ment, combined with the wide scattering of the population, have made schools for a difficult problem, but the local self-governments have done much.

Russia's experiment in national prohibition is given the highest praise. The rent price of a pint of vodka—26 rubles—answers the question whether the de has been avoided. The measure has been reflected not only in the productive effici of the people, but also in their savings, which from an average monthly deposi 3,000,000 rubles in 1913 rose to 50,000,000 in 1916. The revenue formerly der from the government's monopoly can be taken back in taxes and leave the pe better off.

Russia, once the cold storage of Europe, has become the biggest possibility in world. The people have learned to cease dreaming and to act together for their advantage. American business men are advised not to neglect this tremendous ma and field for investment.

R. S. Harve

Lethbridge, Marjorie, and Alan Lethbridge. **The soul of the Russian.** x and pp. John Lane, London; John Lane Company, New York, 1916. $1.25. 8 x 5.

This is a collection of short sketches dealing with the observations and reflect of two English travelers in Russia. Many of the sketches are reprints of papers appeared in the *Outlook,* the *Standard,* and the *Evening Standard.* Although the is not lacking in interest, such slight and desultory studies scarcely deserve their l sounding title. The topics range widely. There is an account of the Pan-Slav apo Krijanich, born in 1617, who warned the Russians in the most stringent terms ag the domination of the Germans. The transference of the capital from Moscow Petrograd is declared by the authors to be a monument to the egotism of Peter Great. Partly owing to its geographical unsuitability and partly to its nearnes Germany, Petrograd has become a denationalized capital, in no sense a Russian

such as Kieff or Moscow. Two of the most interesting chapters in the book are those on "The Ikon" and "Siberia and the War." The ikon is found not only in every room of every house but also in all public places, a constant reminder to the Orthodox of the presence of his Creator. The Trans-Siberian railway and the war with Japan are described as the forces which caused the awakening of Siberia. The latest impulse to Siberian development is of a curious origin. Thousands of prisoners from Galicia and Hungary were sent there early in the war. Many of these men had learned trades, they were hardy, had some education, and, in short, became ideal colonists of exactly the type needed for the development of industries in Siberia. Most of them have voluntarily entered employment and it is expected will remain in Siberia after the war.

R. S. HARVEY.

BALKAN STATES, INCLUDING RUMANIA

DWIGHT, H. G. **Saloniki.** Ills. *Natl. Geogr. Mag.*, Vol. 30, 1916, No. 3, pp. 203-232.

HERBERT, MURIEL. **Serbia and the Serbians.** 114 pp.; map, ills. Waifs and Strays Society, London, 1916. 1s. 7 x 4½.

KEHL, J. E. **Saloniki.** *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 7a, pp. 10-28. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

LA GORCE, J. O. **Roumania and its Rubicon.** Ills. *Natl. Geogr. Mag.*, Vol. 30, 1916, No. 3, pp. 185-202.

MARTONNE, EMM. DE. **La Roumanie et son rôle dans l'Europe orientale.** Map, bibliogr. *La Géographie*, Vol. 30, 1914-15, No. 4, pp. 241-250. Paris.

MAULL, OTTO. **Vorläufiger Bericht über eine Studienreise durch den Peloponnes und Mittelgriechenland.** *Mitt. der Geogr. Gesell. in München*, Vol. 9, 1914, No. 3, pp. 488-494.

PETROVITCH, W. M. **Serbia, her people, history, and aspirations.** 280 pp.; ills. F. A. Stokes Co., New York, [1915]. $1.50. 7½ x 5.

TABET, E. G. **The future of Constantinople and the Caliphate.** *The Nation*, No. 2673, Vol. 103, 1916, Sept. 21, pp. 276-278.

WALDO, F. L. **A sea-trail from Serbia (September, 1915).** *Bull. Geogr. Soc. of Philadelphia*, Vol. 14, 1916, No. 2, pp. 60-67.

WEDDELL, A. W. **Athens.** *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 7a, pp. 1-9. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

WEDDELL, A. W. **Greece.** 6 pp. *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 7b. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

—— ***Balkan peninsula, The theatre of war in.*** 1:1,140,000. Edw. Stanford, London, 1916.

COLOCCI, A. ***La futura Balcania secondo le pretese degli Imperi Centrali*** [with text]. 1:3,000,000. Istituto Geografico de Agostini, Novara, 1916.

EVANS, SIR ARTHUR. ***Diagrammatic map of Slav territories east of the Adriatic.*** 1:2,000,000. Accompanies "The Adriatic Slavs and the Overland Route to Constantinople" by Sir Arthur Evans, *Geogr. Journ.*, Vol. 47, 1916, No. 4.

—— ***Gallipoli, map of the Anzac position, to illustrate Sir Ian Hamilton's despatch December 11th, 1915.*** 1:20,000. Geographical Section, General Staff, War Office, London, 1916.

GROSS, ALEXANDER. ***The Daily Telegraph war map No. 10.*** [Map described in advertisement as "Balkans and Eastern Europe."] Inset: Northern Serbia. 1 in. to 32 mi. (1:2,027,520). "Geographia," Ltd., London, 1916.

AFRICA

SAHARA, INCLUDING EGYPT

—— **Almanac for the year 1916.** viii and 248 pp.; index. [Egyptian] Government Press, Cairo, 1915. 5 P. T. 7 x 5.

ANDREA, R. N. **La produzione e l'industria dello zucchero in Egitto.** 8 pp. *Boll. Gen. degli Affari Comm.* [*Bull.*] *No. 8*, Minist. degli Affari Esteri, Rome, 1916.

BANSE, EWALD. **Die libysche Wüstenplatte und die Marmarika.** Map, ills. *Petermanns Mitt.*, Vol. 62, 1916, Sept., pp. 333-337.

BEAUGÉ, CHARLES. **Notes sur l'Égypte: Voyage dans le désert de Basse-Thébaïde aux couvents de Saint-Antoine et de Saint-Paul.** *Bull. du Comité des Trav. Hist. et Sci.: Sect. de Géogr.*, Vol. 29, 1914, pp. 136-154. Minist. de l'Instr. Publ. et des Beaux-Arts, Paris.

BLACKMAN, A. M. **The rock tombs of Meir: The tomb-chapel of Senbi's son Ukh-Hotp** (B. No. 2). 46 pp.; diagrs., ills., index. *Archæol. Surv. of Egypt, Memoir 23.* London, 1915.

CATELLANI, ENRICO. **L'Egitto dal dominio ottomano al protettorato britannico.** *Riv. Colon.*, Vol. 11, 1916, No. 1, pp. 1-16; No. 2, pp. 73-88.

CLARKE, SOMERS. **Ancient Egyptian frontier fortresses.** Map, diagrs. *Journ. of Egyptian Archæology*, Vol. 3, 1916, Part 3, pp. 155-179. [Fortresses on the barrier of the Second Cataract.]

DORSEY, W. R. **Libya.** 8 pp. *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 74a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

—— **Égypte, Bulletin mensuel du commerce extérieur de l', avec appendice sur le Soudan.** Vol. 30, Nos. 3-11 (March-Nov., 1916). 35 pp. each. Direction Générale des Douanes Egyptiennes, Alexandria.

—— **Égypte, Résumé comparatif du commerce extérieur de l', années 1884-1915.** lxii and 216 pp.; diagr., index. Direction générale des Douanes Egyptiennes, Alexandria, March, 1916.

GARRELS, ARTHUR. **Egypt.** 8 pp. *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 68a. Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

HURST, H. E. **Note on high temperatures experienced in Egypt in June, 1915.** Map, diagr. *Quart. Journ. Roy. Meteorol. Soc.*, No. 177, Vol. 42, 1916, pp. 55-56.

KING, W. J. H. **The nature and formation of sand ripples and dunes.** Diagr., ills. *Geogr. Journ.*, Vol. 47, 1916, No. 3, pp. 189-207.

LARGEAU, GÉNÉRAL. **Le territoire militaire du Tchad en 1913.** *Renseign. Colon.* 1915, No. 5, pp. 125-141.

LÖFLER, —. **La pacification du Tibesti (1913-1914): Rapport d'ensemble du chef de la colonne.** Map. *Renseign. Colon. (Suppl. à l'Afrique Franç.)*, 1916, No. 7 pp. 173-199.

—— **Public Works during 1914-1915, including January, February, and March 1914. Report of the Under Secretary of State of the Ministry of.** 126 pp.; maps diagrs., ills. Ministry of Public Works, Cairo, 1916. [Devoted chiefly to irrigation.]

ROLOFF, GUSTAV. **Napoleons ägyptische Expedition im Jahre 1789 als Kampf mittel gegen England.** 22 pp. *Meereskunde: Sammlung volkstümlicher Vorträge* Vol. 8, 1915, No. 12. Berlin.

SMYTH, W. H. **Le coste della Libia e le vie da Tripoli per l'interno dell' Africa** *Archivio Bibliogr. Colon.*, Vol. 1, 1915, No. 2-3-4, pp. 157-163. Florence.

STUART, M. V. **Napoleon's map of the Nile Delta.** *Cairo Scientific Journ.*, No 99, Vol. 8, 1914, pp. 272-274. Cairo.

—— **Suez, Le Canal de.** *Bull. Décadaire de la Campagne Universelle du Canal Maritime de Suez*, No. 1537, 1916, June 9, pp. 6089-6104. [According to the statistics here given, the tonnage of vessels passing through the canal in 1915 was nearly 24 per cent less than in 1913, the last year of normal traffic. Though the diminution practically represents the tonnage of eliminated enemy vessels it does not show the real depreciation in commercial movement: this, obtained by deducting the special business created by the war, amounts to 40 per cent. Returns of passenger traffic show similar effects. Whilst some thousands of soldiers were carried the reduction of civilian passengers resulted in a large net loss on the figures of normal years. A considerable percentage of the loss is attributed to the suppression of the Mecca pilgrimage.]

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THE CARPATHIANS: PHYSIOGRAPHIC FEATURES CONTROLLING HUMAN GEOGRAPHY*

By EMMANUEL DE MARTONNE
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[With separate map, Pl. IV, facing p. 432.]

Though the Carpathians are one of the great mountain chains of Europe they are not so widely known as the Alps. They have no glaciers and no igh mountain scenery to attract the tourist. History has rarely been ravely affected by them, and only the great European war has revealed heir strategical importance. Very few physiographers have carried on laborate field studies in the Carpathians. We even have no accurate opographical maps of portions of the Southern Carpathians, and the writer n studying this region was obliged first to survey extensive areas and in loing this discovered twenty unnamed lakes in the Paringu massif. Nevertheless the Carpathians, no less than the Alps, teach some wonderfully clear essons in physical and human geography.

The length of the Carpathians, measured from Pressburg to the Iron Gates, is nearly equal to the length of the Alps, and the area is likewise he same. But the mean height is much lower, and the maximum height s a little more than half (Tatra, 2,663 meters, or 8,737 feet; Mont Blanc, ,810 meters, or 15,781 feet). The Carpathians are ordinarily believed to e a true "alpine chain," that is to say, one of those young folded mounains which extend across Europe and Asia from the Pyrenees to the Iimalayas. Their outline is that of a bow, with a more definitely marked uter front; but the map (Pl. IV) shows that the bow is nearly broken n the middle. The width of the chain is reduced at this point from 300 to ss than 100 kilometers (180 to 60 miles); its mean height falls below

* The following comment on the spelling of place-names in the article and on the map may be serceable. Hungarian and Rumanian names are given in their native form, diacritical marks being nitted, however; and no phonetic transliteration has been attempted except in the case of the imanian ţ, which has been rendered *tz*. In addition it should be borne in mind that Hungarian *s* and imanian ş are pronounced *sh*, e.g. Fogaras, *Fogarash*; Piteşti, *Piteshti*; Arges, *Argesh*, etc.

1,000 meters (3,300 feet), and a group of very low passes connects the head-waters of the Dniester with those of the Tisza.

This peculiar feature is one of greatest importance because it controls in a fundamental way the biogeography, economic life, and military strategy of the area. We know from the studies of Pax[1] that important types of vegetation extend bandlike through the Dukla Pass. Three railroads cross the Carpathians in this region, viz., by the Lupkov Pass, the Uzsok Pass, and the Verecze Pass. It is by these easy passes that the Magyars, coming from the plains of southern Russia, made their way to the plain of the middle Danube, which they have occupied since the eighth century. In the present war, this is the only place at which the Russians have yet succeeded in crossing the Carpathians and menacing the capital of the Austro-Hungarian Empire.

That a young folded mountain range is so shrunk in the middle of its now can be explained only by downwarping and breaking. As a matter of fact, the great Hungarian plain, which here extends northward into the very heart of the Carpathians, has been proved to be an area of continuous subsidence, its Neocene beds extending 1,000 meters (3,300 feet) below sea level. The upper Tisza flows at an altitude of only 100 meters even at the foot of the mountains. All the geological horizons exhibited in the Carpathians are missing here, and what remains of the range is only the outer belt of flysch* sandstones. Volcanic massifs show by their structure and distribution that fracturing accompanied downwarping.

Through this shrinking the Carpathians were divided into two masses, now entirely different as to orographic and geologic structure and no less different regarding their biogeography and human geography.

The Northern Carpathians, although bearing the highest peaks of the whole chain (Tatra, 2,663 meters, or 8,737 feet), have not so great a mean height as the Southern Carpathians. They appear as a complex of isolated massifs, broad and low depressions and basins—an extremely shattered range; while in the Southern Carpathians the most striking feature is the great basin of Transylvania, surrounded on all sides by high massifs. The geological structure of the Northern Carpathians is very complicated, and in this respect it is hard to find any relation between the Northern and the Southern Carpathians. The only formation which extends from one to the other is the outer belt of folded flysch sandstones, and even these do not continue into the Transylvanian Alps.

Because of the location of this part of the range the climate and the plant life of the Northern Carpathians are like those of the bordering plains of Poland. In the Beskids a dense forest of firs and beeches extends down to

[1] F. Pax: Grundzüge der Pflanzenverbreitung in den Karpathen, Vol. 1 (*Die Vegetation der Erde*, edit. Engler and Drude, Vol. 2), Engelmann, Leipzig, 1898.

* Flysch is the name, of Swiss origin, given to the complex of marly and sandy shales and soft sandstones, probably of Eocene or Oligocene age, which accompany the outer, convex border of the Alps and the Carpathians.—Edit. Note.

the very foot of the mountains. The timber line is remarkably low, the alpine zone commencing at 1,400 meters (4,600 feet) in the Tatra. The vine is not grown; few fruit trees are seen, except in the southernmost massifs bordering the great Hungarian plain. The climate of the Southern Carpathians is continental to a high degree, and the winters are as severe in the Transylvanian Basin as in the valleys of the Beskids, but the summers are warmer. The vine is grown everywhere, and corn is cultivated up to 800 meters (2,600 feet). The timber line is found at 1,800 meters (5,900 feet). The alpine flora is richer. The subalpine forest zone, with fir and beech, does not extend down to the lowlands; it is the oak forest which covers the basal slopes.

Even in ethnographical conditions and economic life there are striking contrasts between the Northern and the Southern Carpathians. The former are inhabited mainly by North Slavs, while the Magyars penetrate the valleys which open widely southward to the great Hungarian plain, and their distribution coincides precisely with the dry climate, the oak forest, the vineyards, and the loess soil which is so well fitted for wheat culture. The Southern Carpathians are the domain of the Rumanians. Magyars appear only in the Transylvanian Basin, while the Ruthenians occupy the northern corner in Bukovina and eastern Galicia. The upper limit of the permanently inhabited region is everywhere much lower than in the Alps, but it seems to be particularly low in the Northern Carpathians, where, with the exception of some mining towns, we find that even villages do not occu[r] higher than 700 meters (2,300 feet). By contrast, in the Southern Car[-]pathians fields and small villages may occasionally be seen as high as 1,00[0] meters (3,300 feet). Pastoral life is much more developed, and in the sum[-]mer large flocks of sheep graze over the flat-topped ridges above the timbe[r] line.

The Northern Carpathians are not easily accessible from any importan[t] commercial highway. The railways avoid crossing them, as, for exampl[e] the main line from Vienna to Cracow and Lemberg. The Southern Ca[r-]pathians cannot be avoided by the commerce directed to the Orient an[d] are crossed by two trunk railways with express service, namely, at the Iro[n] Gates and at Predeal Pass, and by three railways of less importance, mainl[y] by way of the transverse valley of the Olt (Red Tower Pass), the pas[s] between the upper Olt and the Sereth (Gyimes Pass), and the pass betwee[n] the headwaters of the Tisza and the Pruth (Jablonica Pass).

The Transylvanian Alps

It is in the Southern Carpathians that the most intensive physiographi[c] studies have been carried on.[2]

The Transylvanian Alps form the southernmost part of the Carpathian[s]

[2] E. de Martonne: Recherches sur l'évolution morphologique des Alpes de Transylvanie (Karpat[es] méridionales), *Revue de Géogr. Annuelle*, Vol. 1, 1906-07, pp. xi-xxi (bibliography) and 1-279.

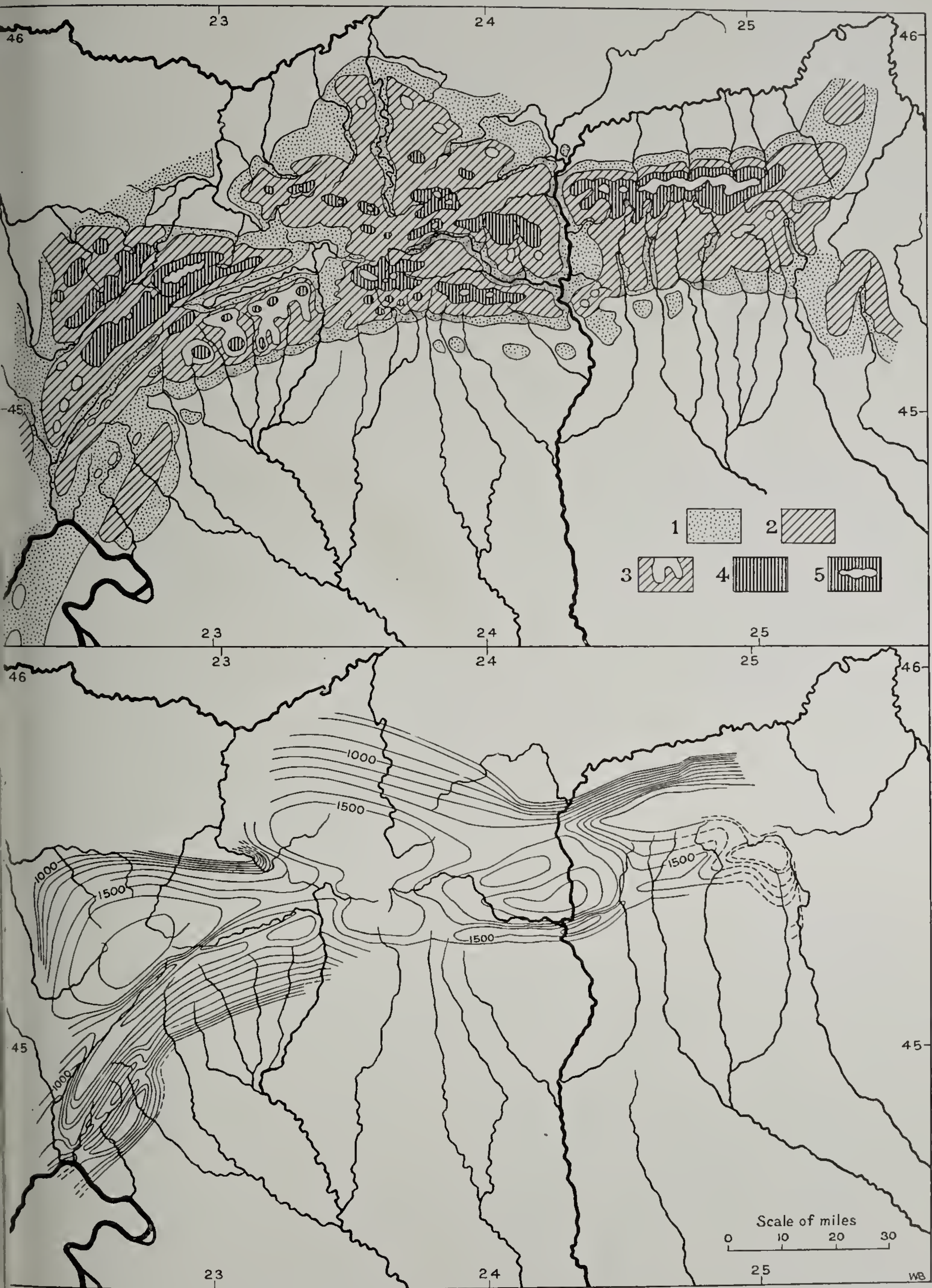


FIG. 3 (Upper)—Map showing the extent of the forms of advanced maturity developed in the Transylvanian Alps at three successive stages. Scale, 1:2,300,000. Key to legend: (1) Gornovitza platform (Pliocene); (2) Riu Ses platform (late Miocene); (3) maturely dissected Boresco monadnocks; (4) Boresco platform (probably early Miocene); (5) pre-Boresco monadnocks.

(Lower)—Map showing the present altitude of the Riu Ses platform as a result of diastrophic movements. Scale, 1:2,300,000. Interval of structure contours, 100 meters.

(Fig. 3 is redrawn from Fig. 55-56 of the author's "Recherches, etc.," cited in footnote 2.)

and extend from the Iron Gates to the Prahova River. No part of the Carpathians appears so compact. Many ridges are more than 2,000 meters (6,500 feet) high, some reaching 2,500 meters (8,200 feet), and the mean height of the summits is nearly 1,800 meters (5,900 feet). There are few longitudinal valleys, while transverse valleys, cutting the whole mountain mass, are occupied by streams which come from the Transylvanian Basin, cross the highest ridges, and flow to the lower Danube—as the Jiu (Fig. 1), the Olt (Figs. 2 and 11), and the Buzeu. These valleys are not everywhere such wild gorges as the Surduc (gorge of the Jiu) or the Red Tower Pass; and they have consequently been followed by migrating peoples and especially by strong military forces crossing the range. This was particularly the case with the Olt valley at the time of the wars between the Turks and Hungarians, and it is likewise the case in the present war.

But the most remarkable feature of the Transylvanian Alps is the flatness of most of the ridges, even when they reach an altitude of 2,000 meters (6,600 feet). Indeed the hardest climbing in these mountains has to be made, as a rule, at the beginning, over primitive pathways, while you are ascending from the valleys, which are often wild gorges and nearly everywhere remarkably profound and steepsided. But after you have reached the crest, you can walk or ride whole days on comparatively good paths in the midst of a splendid forest. When you have risen above the timber line, you travel over extensive pasture grounds, dotted, at the beginning of summer, with the most beautiful alpine flowers. This is the domain of the Rumanian shepherds; they call these heights *plaiuri,* that is to say "the paths" (Fig. 9).

The contrast between the topographic youth of the valleys and the topographic maturity of the heights suggests the idea of a physiographic evolution involving peneplanation and rejuvenation. The geological structure of the Transylvanian Alps, as shown by the studies of Rumanian and Hungarian geologists, is alpine. The geological map shows a great extent of schists, which are referred to two series corresponding to two great overthrust masses, and a small extent of Mesozoic limestones, shales, and sandstones corresponding to an intermediary overthrust mass. Neocene beds appear only on the border and in some basins in the interior, revealing superficial folds and faults without any relation to the dislocations of the overthrust masses but sometimes in close relation to the relief and the network of valleys.

Investigations have shown that the Transylvanian Alps exhibit three series of flat-topped ridges, corresponding to three periods of more or less extensive peneplanation after the piling up of the overthrust masses which gave the range its elevated character (Fig. 3). The highest flat-topped ridges appear sometimes at 2,000 meters (6,600 feet). This surface I have called the Borescu level, from the mountain which exhibits the most remark

able example of it (see panorama, Fig. 5). Indeed you can walk all day long in the fog on the slightly undulating plateau and cross swampy grounds with peat bogs, without knowing where you are, until the wind suddenly shifts, the fog is dispelled, and you find yourself on the verge of a valley a thousand meters deep.

The Boresco surface is very old, probably of early Miocene age, and is only preserved in some of the highest massifs. It has been much modified

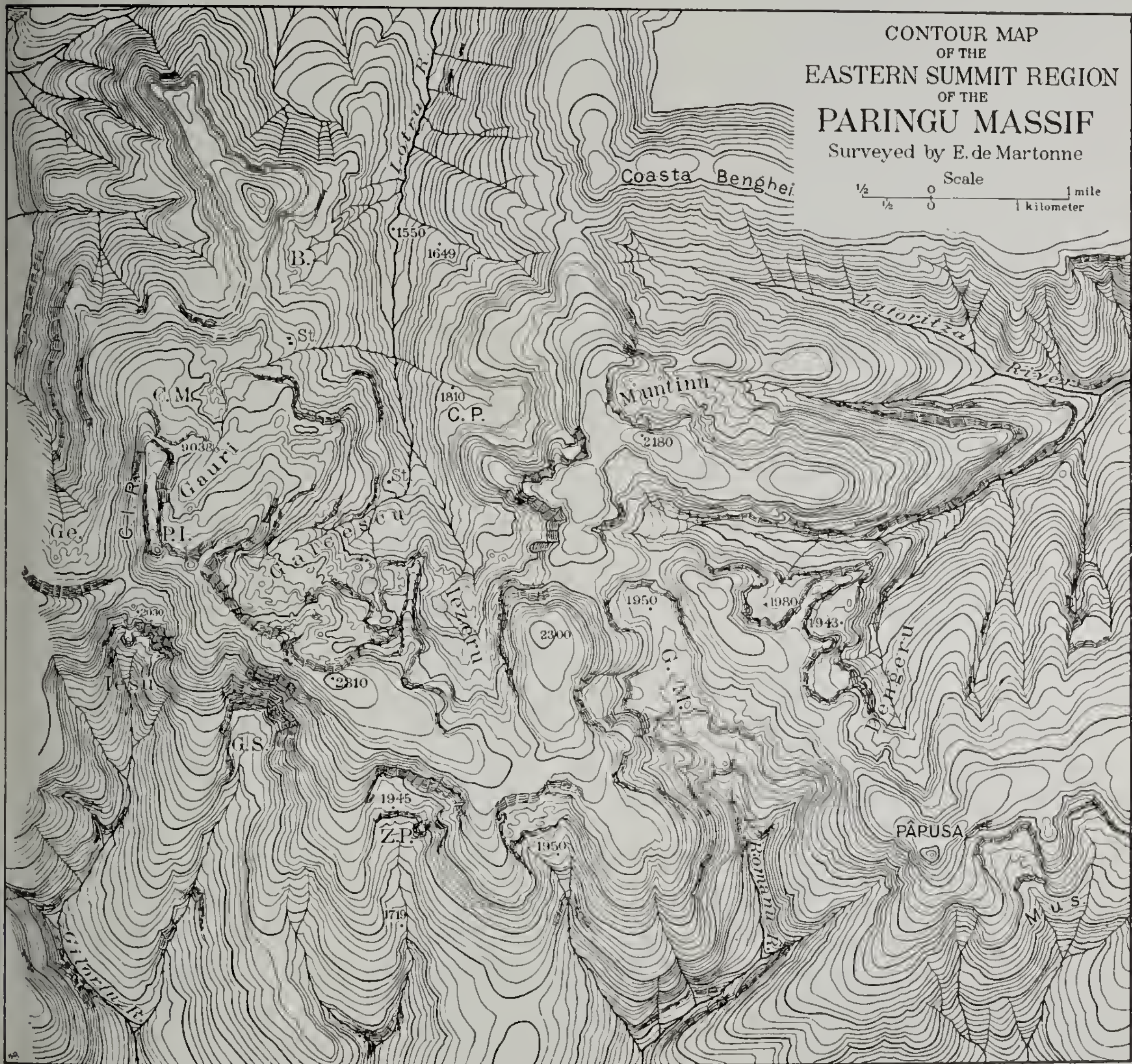
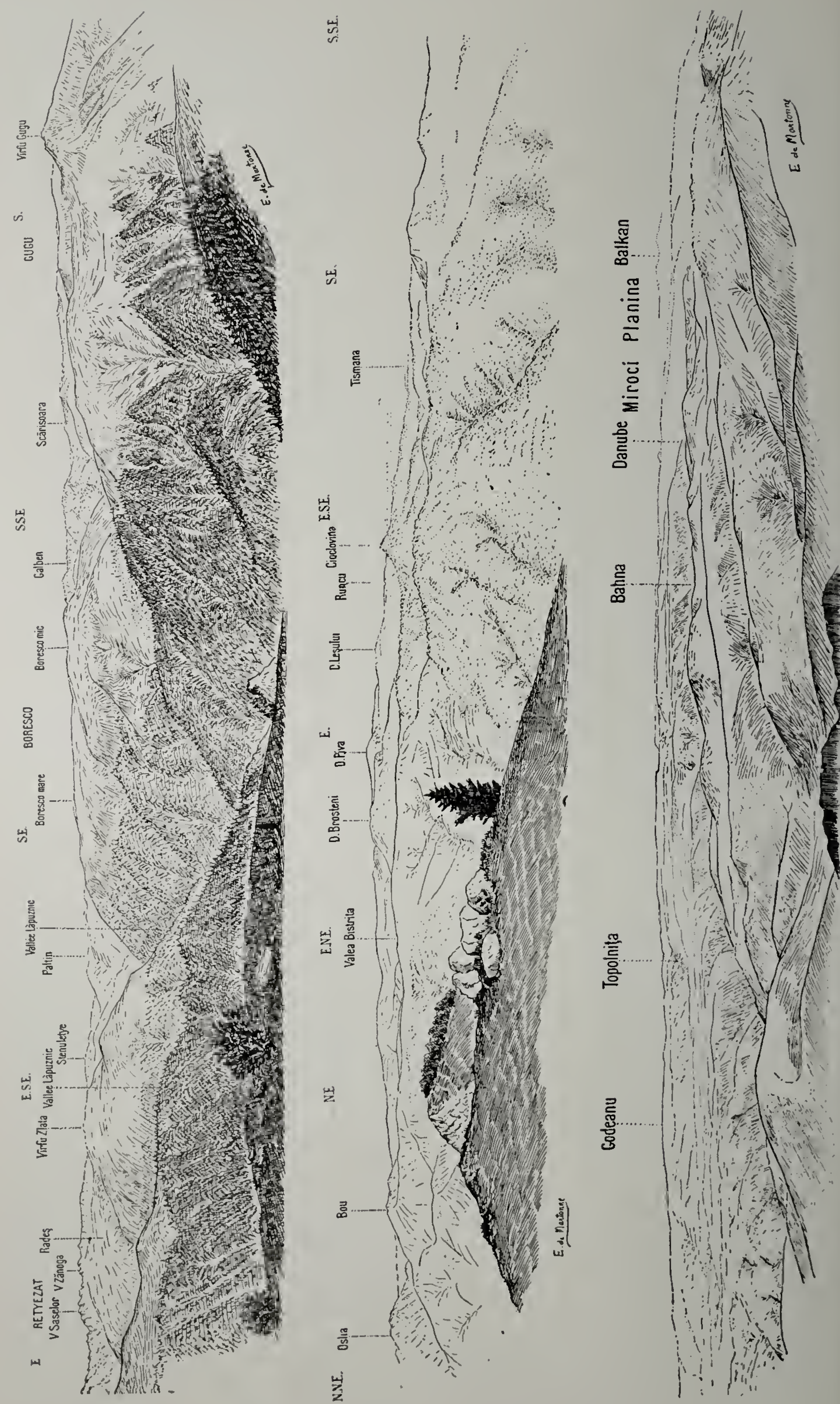


FIG. 4—Contour map of the eastern summit region of the Paringu massif, Transylvanian Alps, reduced from the author's original survey in 1:25,000, showing glacial cirques and the great extent of the Boresco platform. Scale, 1:110,000. Contour interval, 20 meters. (Redrawn from Fig. 57 of the author's "Recherches, etc.," cited in footnote 2, which consult for key to abbreviations.)

by the action of local Pleistocene glaciers. Beautiful cirques with precipitous walls, carved in the domed surface of the Paringu massif, locally give it the appearance of an alpine mountain with sharp ridges and many lakes (Fig. 4). Where the peneplanation was not completed in Boresco time monadnocks were left standing above the Boresco platform, and these have been extensively scalloped on both sides by great cirques or even by glacial valleys containing beautiful examples of trough steps and rock



Figs. 5-7—Three panoramic views in the western Transylvanian Alps, drawn with a *camera lucida*.

basins. Sharp ridges, pyramid-like peaks, and narrow passes have been developed in this way in the Retiezat and the Fogaras massifs.

The second surface from which flat-topped ridges have been derived by erosion is called the Riu Ses. It is the greatest in extent, and we may assume that it was a true peneplane surface, developed in the late Miocene, as shown by the study of its contact with the Tertiary hills in the Mehedintzi plateau. To the west of Hermannstadt it appears as a plateau dissected by many valleys into parallel flat-topped ridges which descend regularly to the north.

Where the Boresco surface is preserved over a large extent the Riu Ses surface forms young dissected esplanades, as in the Retiezat massif, or old valleys, as in the Riu Ses region itself. Sometimes Boresco monadnocks stand above it in the form of table-like reliefs, as in the Vulcan Mountains (Fig. 6).

It is on the flat-topped ridges, remnants of the dissected Riu Ses surface, that most of the old trails of the Transylvanian Alps are located. The well-known "Vulcan Pass," which has been often referred to in the present war, is not the wild gorge of the Jiu, as shown in many newspaper maps; neither is it a true pass. It is one of the *plaiuri* frequented by the shepherds. In this particular case the road follows a Riu Ses ridge which slopes gently to the south, thereby avoiding the wild gorge of the Jiu. This road was known to the Roman soldiers and merchants; and, before the building of the modern and expensive road in the Surduc gorge, it was the only means of communication between the mining town of Petroseny and the great market of Targu Jiu. Starting from the Petroseny side it is hard to reach the top, and this part of the road was strongly defended by the Rumanians in the autumn campaign of 1916. When you are once on top, on the Riu Ses surface, you can descend without difficulty to the Targu Jiu basin to the south.

The most recent surface is the Gornovitza surface, which exhibits a late-mature topography, developed on Pliocene strata. Its extent is not so great as the extent of the Riu Ses surface, and it appears ordinarily in the form of young dissected esplanades, as to the south of the Vulcan Mountains, with wild gorges cut in the Mesozoic limestones, or in the form of old valleys, now more or less dissected, making shoulders or rounded terraces above the present bottom of the young valley. The Surduc gorge is cut in such an old Pliocene valley, as is also the transverse valley of the Olt.

The whole physiography of the Transylvanian Alps, with the exception of the glacial forms of the highest Boresco summits, is explained by the extent of the deformation and dissection of the three surfaces of old maturity, developed at three different periods. Such features should influence, at least to some degree, the biogeography of the area and even its human geography. As a matter of fact, the alpine flora is richer in the Transylvanian Alps than in other parts of the Carpathians and especially

where the Boresco or Riu Ses surfaces extend above the timber line and are cut in limestone and sandstones, as in the Bucegi massif. We have already stated that the shepherds use the flat-topped ridges called *plaiuri* as pasture grounds. The great extent of these alpine and subalpine meadows and the vicinity of the steppe plains of Wallachia explain the annual migrations of the Rumanian shepherds, who spend the summer in the mountains and the winter in the plains. The sheep that are taken to the Baragan Steppe and even to the Dobrudja are often owned by peasants from Transylvania, and many of the shepherds are Transylvanians.[3] Villages recently established in the steppes of Muntenia are inhabited by Rumanian peasants from Transylvania, of whom many have been shepherds.

No one who has lived with shepherds in the mountains can fail to remark how pastoral life conduces to the preservation of old habits and peculiar customs. This makes it less difficult to understand how the Rumanians could remain a distinct people with a Latin language, while during many centuries wave after wave of barbaric invaders rolled over the plains of the lower Danube.[4]

While the flat-topped ridges extending near and above the timber line are used as pasture grounds and scattered with small, temporarily inhabited, wooden houses called *stine* (Figs. 10, 14, 15), many of the shoulders, rounded terraces, flat-topped ridges, and plateaus extending down into the forest zone below 1,200 meters (3,900 feet) are occupied by farms with meadows and orchards. In the main the villages lie near the floor of the valley; but many peasants own a small farm on a shoulder nearby, where they keep cattle in the summer. The great extent of comparatively high-standing flat-topped ridges and their use as pasture grounds by shepherds migrating to the plains of the lower Danube may be considered as one of the reasons why pastoral life has not developed in the same way as in the Alps, why so few villages are found above the valley floor, and why the limit of the permanently inhabited region is at a comparatively low elevation.

We must here note a peculiar feature of the Transylvanian Alps, the study of which not only affords evidence regarding the successive stages of deformation and erosion of the mountains but explains many interesting features of their human geography. It is what has been termed "sub-Carpathian depressions." The most conspicuous of them is the depression of Targu Jiu, which the Jiu enters when issuing from the wild Surduc gorge before cutting into the Tertiary hills of Oltenia. There are many such depressions in Oltenia and in Muntenia, appearing as a chain of flood-plains or of young dissected alluvial plains between the range itself and the wooded and strongly dissected Tertiary hills. We know that all these depressions originated as synclines on the contact of the old rock masses

[3] E. de Martonne: La Valachie: Essai de monographie géographique. Colin, Paris, 1902.

[4] E. de Martonne: La vie pastorale et la transhumance dans les Karpates méridionales: Leur importance géographique et historique, in "Ratzel Gedenkschrift," Seele & Co., Leipzig, 1904, pp. 227-245.

and the Neocene beds. Pontian marls are folded in western Oltenia; late Pliocene gravels are dislocated in western Muntenia; Pleistocene terraces are tilted and in some places broken by flexures in eastern Muntenia.

The sub-Carpathian depressions are drier and warmer than the surrounding country. They have few woods, are very well cultivated, and are more densely populated than even the Tertiary hills.[5] The villages seem prosperous. Wealthy peasants are not unknown. Every one possesses cattle, fields, and orchards; and the village community owns heavily timbered mountains with pasture grounds. It is in such places that you find Rumanian costumes in their most typical and beautiful form. History tells us that, while the peasants in the whole of Wallachia were serfs, most of the villages of the sub-Carpathian depressions were inhabited by *moshneni,* i. e., freemen, who owned their own fields and homes.

Small towns have developed in every sub-Carpathian depression, such as Targu Jiu, Ramnic, and Campulung; they lie at the head of commercial routes crossing the range. In the present war the rôle of the sub-Carpathian depressions has been quite remarkable. The defeated Rumanians rallied in the Targu Jiu depression and in the Campulung depression to check the Germans; and stubborn battles were fought at such places.

The Transylvanian Basin and the Bordering Mountains

The Transylvanian Alps are only a part of the Southern Carpathians, which form the southern border of the Transylvanian Basin.

The western border, the Bihar massif, seems to have the same geological structure and the same physiographic history as the Transylvanian Alps, although its height and extent are not so great. The Riu Ses surface seems once to have extended over the larger part of this region. The highest summits of today are probably Borcseo monadnocks fringed in some cases by very small cirques. Where the old surface was cut in limestones and is dissected only by wild narrow gorges, the fields and villages are on the heights; where it is cut in schists and dissected by more open valleys, the population lives in the valleys, as in the Transylvanian Alps.

Pliocene shore lines have been discovered to the west by Sawicki.[6] They seem to correspond to the highest terraces of the Maros and to the summit of the Tertiary hills of the Transylvanian Basin. The Neocene beds are slightly undulating and even faulted in places, and it is therefore clear that the Transylvanian Basin had the same physiographic history as the smaller basins of the Transylvanian Alps, which have been more or less disturbed by the deformations of the old rock masses of the mountains. In addition they were peneplaned in the Pliocene and strongly dissected later.

[5] E. de Martonne: Recherches sur la répartition géographique de la population en Valachie, *Bull. Soc. Geogr. Romina (Bukharest)*, Vol. 23, 1902, No. 2 (= pp. 1-161).

[6] L. Sawicki: Beiträge zur Morphologie Siebenbürgens, *Bull. Internatl. de l'Acad. des Sciences de Cracovie: Classe des Sciences Math. et Nat., Ser. A*, 1912, pp. 130-265.

FIG. 8.

FIG. 9.

FIG. 8—The Beskidic peneplane surface of the Northern Carpathians and the first Beskidic monadnocks. (Photo by W. Lozinski.)

FIG. 9—Flat-topped ridges, called *plaiuri*, i.e. the paths, in the Transylvanian Alps. View taken in the Capatzina Mountains, looking west. In the background the sky line shows the level summits of the Paringu massif (high Boresco platform).

FIG. 10.

FIG. 11.

FIG. 10—Deforestation associated with pastoral life in the Southern Carpathians. In the right middleground a recently established *stina*, or shepherd's house; in the background the Sireu, a characteristic monadnock summit of hard conglomerates in the Moldavian flysch Carpathians near the headwaters of the Buzeu River.

FIG. 11—Transverse valley region of the Olt River: a tributary valley near the village of Titesti. Alluvial terrace with villages, fields, and orchards.

The development of such broad plains as the plains of Hatzeg, of Fogaras, and the Haromszek basin is simply the result of the rapid erosion of the soft Levantine beds. The stages of erosion are clearly shown by the terraces.[7]

The physiography of the mountains bordering the Transylvanian Basin in the east has not yet been worked out. We only know that the Hargitta is a complex volcanic mass, in which the original slopes may easily be reconstructed, and which has blocked the upper valleys of the Maros and the Olt, forming the basins of Gyergyö and Csik.[8] It lies at the very place where one would expect to find the continuation of the Transylvanian Alps, by following the strike of the schists, and shows how much breaking and sinking is responsible for the outline of the Southern Carpathians. The Rodna Mountains are a remnant of those old masses, and appear as the duplicate of the Fogaras Mountains in the Transylvanian Alps, a bold, heavily timbered, strongly glaciated alpine chain, with cirques and small troughs.[9]

The greater part of the Moldavian Carpathians, which are built of closely folded flysch sandstones, still awaits physiographic investigation. On several reconnaissance tours I gained the impression that the highest summits, formed of conglomerates and hard sandstones, are Riu Ses monadnocks, and that most of the round ridges are derived from the maturely dissected Gornovitza surface. Interesting facts would certainly be brought to light by studying the sub-Carpathian depressions, which here may better be called intra-Carpathian depressions, for they are separated from the plains and hills of Moldavia by a belt of folded sub-Carpathian ridges.

Surrounded by mountains, the Transylvanian Basin has a dry and extremely continental climate. The winters are particularly severe in the plain of Kronstadt; the summers are exceedingly hot. A loam similar to the loess of southern Russia is found nearly everywhere on the slopes of the hills. The flora of the region called Mezöseg, north of the upper Maros River, is steppelike in character.

It is rather curious to see how the Magyars, coming from the great Hungarian plain, entered the Transylvanian Basin, followed the broad valleys with the loess terraces, and established themselves in the dry plains of Mezöseg and in the Haromszek basin, where you find their large villages and their bighorn cattle. The Rumanians, however, remain the dominating race and show such a power of expansion that they have completely assimilated many Magyar villages and nearly all German colonies. In addition they have been able to cross the mountains and contribute to the colonization of the plains of Wallachia and Dobrudja.

All that we know of the Southern Carpathians goes to show that they are very different from the Alps. The piling up of the overthrust masses

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[7] E. de Martonne, paper cited in footnote 2, pp. 213-216 and 225-227.
[8] L. Sawicki, *op. cit.*, pp. 259-262. [9] *Ibid.*, p. 160.

occurred probably at an earlier time. The main physiographic features are the result of downwarping and upwarping, of partial peneplanation, and of a more or less complete dissection of old mature surfaces according to the hardness or softness of the strata.

The human geography of the area is not less peculiar than the physiography and is partially controlled by the physiographic features. Pastoral life with extensive migrations is a typical feature and may account for the preservation of the Rumanians as well as their extension over Transylvania and Wallachia.

The Northern Carpathians

Geological and topographic mapping has been more completely carried on in the Northern Carpathians than in the Southern. However, physiographic investigation has only begun, and much remains to be done to understand the development of the relief.

The most striking feature is the contrast between the outer belt of parallel ridges, apparently regularly folded flysch sandstones, and the inner belt, exhibiting the most confusing alternation of isolated small massifs and more or less closed basins of highly complicated geological structure: schists and granite, Paleozoic and Mesozoic layers, flysch, and even large volcanic masses.

The outer belt may be called the Beskids. We know from borings in Wielicz that their structure is not so simple as it appears and that we have to do with overthrust masses advancing over the Neocene beds to the north.[10]

The physiographic studies of Sawicki[11] have shown how the slightly undulating surface to the south of Cracow is a peneplane of Miocene age, above which stand some monadnocks (Fig. 8). Southward the surface rises, the monadnocks become more strongly developed, making parallel ridges, while the surface continues in the form of a network of old valleys. From the statements of Sawicki one may infer that this surface was formed in the Riu Ses cycle of landform development, but it has been partially downwarped, and buried under Neocene sediments, to be exposed again by the removal of the soft beds covering it.

Whatever may be its history, this peneplane is a striking feature of the Beskids, dissected as it is by comparatively wide valleys, except where it is cut on limestones. The network of old valleys was followed by the Slav colonization coming from the north. Woods were cleared, small villages established, and little houses built here and there along the rivers or on the edges of the shoulders representing the floors or sides of the old Miocene valleys. But the woods on the ridges everywhere remain intact. There is a striking contrast between the densely timbered monadnock ridges with their com-

[10] V. Uhlig: Über die Tektonik der Karpathen, *Sitzungsber. der Kais. Akad. der Wiss. Wien: Math.-naturwiss. Klasse, Abt. I*, Vol. 116, 1907, pp. 871-982.

[11] L. Sawicki: Die jüngeren Krustenbewegungen in den Karpathen, *Mitt. der Geol. Gesell. in Wien*, Vol. 2, 1909, pp. 81-117.

paratively steep slopes and the smoothed surfaces covered with fields and meadows and dotted with villages and farms. Southward still farther the old Miocene surface does not rise over 900 meters (3,000 feet), and this is the reason why the inhabited zone is so low in the Beskids. The tops of the highest ridges stand only 100 or 200 meters (330 to 660 feet) above the timber line and can be used as pasture grounds in the summer. Cattle raised in the neighboring valleys are found in every suitable place. But this is nothing as compared with the extensive migrations of the Rumanian shepherds in the Southern Carpathians.

The inner belt of the Northern Carpathians, which may be called the Hungarian Alps, is the most confused part of the whole Carpathian range. Lugeon has shown that it has an overthrust structure, the detail of which has not been worked out.[12] But the topography can only be considered as the result of downwarping and faulting.

Some massifs are flat-topped and resemble the Boresco surfaces in the Southern Carpathians; but they appear at different heights, separated by broad basins, so that only very accurate physiographic studies would yield evidence regarding the ages and the relations of such surfaces.

The highest massifs have been strongly glaciated and are bordered by cirques with large lakes, beautiful troughs, and small hanging valleys, derived from young preglacial torrential valleys. Such is the case with the Tatra, which is a true alpine chain with sharp ridges and precipitous peaks. Other massifs, such as the Nizna Tatra and the Fatra, are simply fringed by small cirques like the Boresco ranges in the Southern Carpathians and still preserve high rolling surfaces which can be used as pasture grounds.

The basins are not directly due to downwarping and faulting. They ordinarily show a succession of terraces, of which the highest are developed in the form of an esplanade, in many cases entirely surrounding the depression and corresponding to a divide between two neighboring basins. Such esplanades are commonly built on Neocene strata, more or less faulted, or of strongly folded flysch. It seems that the basins have been recently re-excavated after having been peneplaned, like the Petroseny and other small basins of the Transylvanian Alps, probably at the time at which the Transylvanian Basin itself began to be dissected again. The sinking of the Hungarian plain may have contributed to increase the erosive power of the tributaries of the middle Danube. Some captures resulted from this process, the most striking example being the capture of the upper Arva by the Waag.

The contrast found in the Beskids between the densely populated old Miocene surface and the wooded monadnock ridges is not less striking here between the massifs and the basins. The break of slope at the contact of the

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[12] M. Lugeon: Les nappes de recouvrement de la Tatra et l'origine des Klippes des Carpathes, *Bull. Soc. Vaudoise des Sci. Nat.* (*Lausanne*), Ser. 4, Vol. 39, 1903, pp. 17-63.

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massifs and the basin floors is emphasized by a change in the vegetation. A dense forest of fir and beech trees covers the mountain block. On the esplanade, where the light oak forest has been cleared, pasture grounds and some fields occur; but the bulk of the cultivated and inhabited zone is found in the basins. There are a few points in the mountains where the forest has been cleared and settlements of German mining colonies are found at heights of about 1,000 meters (3,300 feet). The highest basins, such as the Neumarkt basin to the north of the Tatra and the Lipto basin to the south, were late in being settled; here Germans founded small towns and built a dense network of agricultural villages. The seattered villages of the Slavs, on the other hand, everywhere occupy the lowest parts of the basins, with fields extending over the terraces. A map of the density of population would emphasize the distinction between the mountain blocks and the basins and would at the same time be a good orographic map.

The southernmost part of the Northern Carpathians is the most shattered. Extensive volcanic masses have been poured out since the early Miocene, covering almost entirely the few remnants of the old folded mountain range. The whole area appears to have been partially drowned by the sinking of the Hungarian plain. Instead of nearly enclosed basins, with terraces, we find broad, open depressions rising by continuous slopes to flat domes.

The dry climate of the plain, marked by clear days, affects the whole region. Dark brown or black soils are found on the lower parts, and the loess extends up to a height of 400 meters (1,300 feet) on the gentle slopes. The Magyars are here as much at home as in the Alföld, the great Hungarian plain. One cannot fail to remark the contrast their large villages make with the small scattered houses of the Slav peasants. They cultivate more wheat, have more cattle, and especially large herds of swine. Vineyards cover the southern slopes.

The range here is more widely open; it almost vanishes in the plain.

Conclusion

The Carpathians may hardly be considered a geographical unit, in contrast to the Alps, which stand as a bold and solid mass, though a large area in the west was drowned in the plain of the Po, and downwarped or faulted basins fringe the eastern extremity, facing the Hungarian plain.

Not so with the Carpathians. They are a much-shattered mountain system, and this shattering seems to have begun very early. The Transylvanian Basin, with its great extent of Neocene layers, was certainly formed just after the first uplift of the range, and probably looked, in late Neocene time, much as does at present the great embayment of the Hungarian plain near the headwaters of the Tisza, by which the Carpathian bow is almost completely broken in two.

FIG. 12.

FIG. 13.

FIG. 12—Decorated entrance to a house in the village of Bumbesti, sub-Carpathian depression of Targu Jiu. Dwelling on the right, stable on the left, orchard in the background.

FIG. 13—House in the village of Bumbesti.

FIG. 14.

FIG. 15.

FIG. 14—Pastoral life in the Transylvanian Alps: a *stina*, or shepherd's house, in the Fogaras Mountains above timber line. Sheep corral on the left, cheese hut on the right.

FIG. 15—Pastoral life in the Transylvanian Alps: a *stina* near the timber line, Paringu massif.

The general scheme of evolution of alpine mountains may be approximately outlined as follows:

(1) Folding, with overthrusting, accompanied or soon followed by uplift.

(2) Erosion and partial or complete peneplanation.

(3) Shattering, by downwarping and faulting, of more or less extensive parts of the mountains.

(4) Uplift accompanying or following the shattering, with erosion and more or less extensive glaciation.

The physiographic features depend chiefly upon the relative importance of these episodes and upon their more or less close succession.

In the Alps the succession has been a very rapid one, so that it is difficult to discern the features due to each episode. The special importance of the last episode has been recognized only in recent years. Uplift is more important than stream erosion.

The development of the Carpathians was slower. Shattering was more important than uplift. The result is that we can recognize much better the forms due to the successive cycles of erosion, especially in the Transylvanian Alps. Flat-topped or subdued summits are dominant. The mean height is very great compared with the maximum height of each massif. Only local glaciers were formed in Pleistocene times, and true alpine ridges are not a common feature.

As a whole, the Carpathians are an open mountain system, with wide, old valleys, as for instance in the Beskids; many small basins, as in the Hungarian Alps and in some parts of the Transylvanian Alps; extensive basins, as the Transylvanian Basin; or even great embayments of the plain penetrating into the very heart of the mountains, as the upper Tisza plain.

The influence of these features on the biogeography and human geography of the region is very apparent.

The subalpine and alpine flora of the Southern Carpathians is in many respects different from the flora of the Northern Carpathians. As a whole the Carpathians are not so heavily timbered or so densely inhabited as the Alps. But while the mean of the uninhabited surface is probably about 60 per cent in the Alps, it is certainly less than 50 per cent in the Carpathians. Man does not need to climb so high; wide valleys or basins are everywhere open to settlement.

The Alps were not able to check the advance of the peoples invading Europe, but they deflected the waves of the invaders to the north and to the south. They have been penetrated by the Slavs and the Germans, though they still form the limit of various languages and nationalities.

The Carpathians not only have been crossed by invaders on various occasions, but, instead of playing the rôle of a wall separating different

peoples, they have served as the center of development of certain nationalities. This is particularly true of the Southern Carpathians, in which we find the citadel of the Rumanians.

In the present great war, the Carpathians, standing between the two groups of belligerents, have been crossed at the north by the Russians and at the south by the Rumanians invading Transylvania and by the Austro-Germans invading Rumania.

The reader is not to gain the impression that the writer believes all features of human geography to be controlled by physiographic conditions. A complete study of the human geography of the Carpathians would involve many considerations that it is not the intention of the writer to present here, and particularly much history. Physiography affords possibilities which are realized by man in varying degree. Certainly there are in the Carpathians some remarkable evidences of the control exercised by the physiographic features upon the development of human activity. Nevertheless the writer does not wish to imply that this human activity developed as it did merely because of what the physiographic history of the range has been, but rather that it could not have been what it is if the range had been built otherwise.

THE CONQUEST OF RUMANIA

By DOUGLAS W. JOHNSON

When in the summer of 1916 Rumania abandoned a position of wavering neutrality and cast in her lot with that of the Entente Allies, the hopes of the Allied powers rose to high levels. Justification for these hopes lay not so much in the fact that Rumania possessed an army reputed to be better trained than that of any other Balkan state, but rather in the advantageous geographic position which the new ally enjoyed. Her two provinces of Wallachia and Moldavia lay like the jaws of an open nutcracker, between which Hungarian Transylvania could be crushed as in a vice. Her peculiar outline added some 800 miles to the length of a battle line already too long for the declining man power of the Teutonic allies. Her western border lay but 40 miles northeast of the Morava-Maritza trench, carrying the Orient Railway, that vital artery which alone assured continued life to the Turkish Empire. Her oil fields and her wheat fields were added to the material resources of the Entente and closed to their sorely beset enemies. Small wonder that Rumania's decision was hailed with delight by the Entente powers.

A few months later all their high hopes lay in the dust. The Wallachian jaw of the nutcracker had been rudely wrenched away. Rumania, not Transylvania, had been crushed. Eight hundred miles of new battle front had been shortened to less than 300 miles. The Orient Railway was still carrying munitions to the Turks. Oil fields and wheat fields were supplying Teutonic conquerors, and the German Chancellor was grandiloquently offering terms of peace to his disappointed foes.

The Rumanian campaign was disconcerting not alone to those most vitally interested in its consequences. The unexpected happened with such regularity that disinterested onlookers found ample need to revise their most confident predictions. More than one military expert would gladly delete whole paragraphs from his published discussions of the campaign and forget prophecies which events failed to justify. From the writings of one such unfortunate there would have to be erased the assurance that the only danger to Bukharest was from the east through an attack from Dobrudja; that no serious attempt would be made to invade Wallachia by way of the passes of the Transylvanian Alps; later, that the Buzeu River was the main defensive line to which the Rumanians were retiring; still later, that this main line was the Sereth-Trotus valley; and finally, that the Sereth-Putna barrier (which proved to be the impassable obstacle to pursuit) was not adapted for defensive purposes.

The key to the Rumanian puzzle is in part geographical, in part political. In the following pages it will be our purpose, first, to analyze the geographic elements of Rumania's surface configuration and strategic position; second, to determine what plans of campaign were dictated by her geography and how far these plans were modified by political considerations; and, third, to trace the effect of land forms upon the detailed movements of armies throughout the campaign. If in the course of this analysis we find a logical explanation for the unexpected and disappointing events in Rumania, our first aim will have been achieved. If, further, we gain therefrom a knowledge of Rumanian military geography which will enable us to interpret future movements of the Allies in attempting to expel the invader, our study will have proved doubly profitable.

The Natural Defenses of Rumania

Few countries are so richly supplied with natural protective barriers as is Rumania. The entire eastern border is shielded by the Pruth River and the Black Sea, the northern and western by the Transylvanian Alps, the southern by the broad marshes of the Danube. Only in the southeast, for a distance of about 100 miles, is there a dangerous gap in the defensive line, the southern border of the province of Dobrudja. Those portions of the border of interest in the present connection are the Transylvanian Alps, the Danube valley, and the unprotected Dobrudja gateway.

The Transylvanian Alps. From the border of Bukovina to the Iron Gates of the Danube the Transylvanian Alps form an unbroken mountain barrier, protecting the low Rumanian plain on the east and south from hostile invasion. They are a direct continuation of the Carpathian Mountains[1] on the north and beyond the Danube connect with the western end of the Balkan Range. Northwestward the mountainous topography is continued by the Hargitta and Bihar masses of Hungary, but in Wallachia and Moldavia the Transylvanian Alps drop down to low foothills, which are in turn bordered by the broad plain, sloping southward or eastward to the Danube. They have an average breadth of some 50 miles or more and usually consist of a main range, bordered on the Rumanian side by secondary ridges or hills, sometimes with a lowland intervening between the two. In the Moldavian sector the secondary crests consist of parallel ridges much like those of the northern Carpathians, and remind an American of the genetically similar Appalachian ranges. It is clear that an invader who succeeded in passing the main range would still have hard fighting before him if he would pierce the secondary defensive barrier and reach the plain beyond.

[1] The dividing line between Carpathians and Transylvanian Alps is variously drawn. De Martonne places it west of the great bend in the range, while others place it north of the bend, near the Bukovina border. For purposes of practical convenience in the present discussion we will use the single term "Transylvanian Alps" for the entire range bordering Rumania.

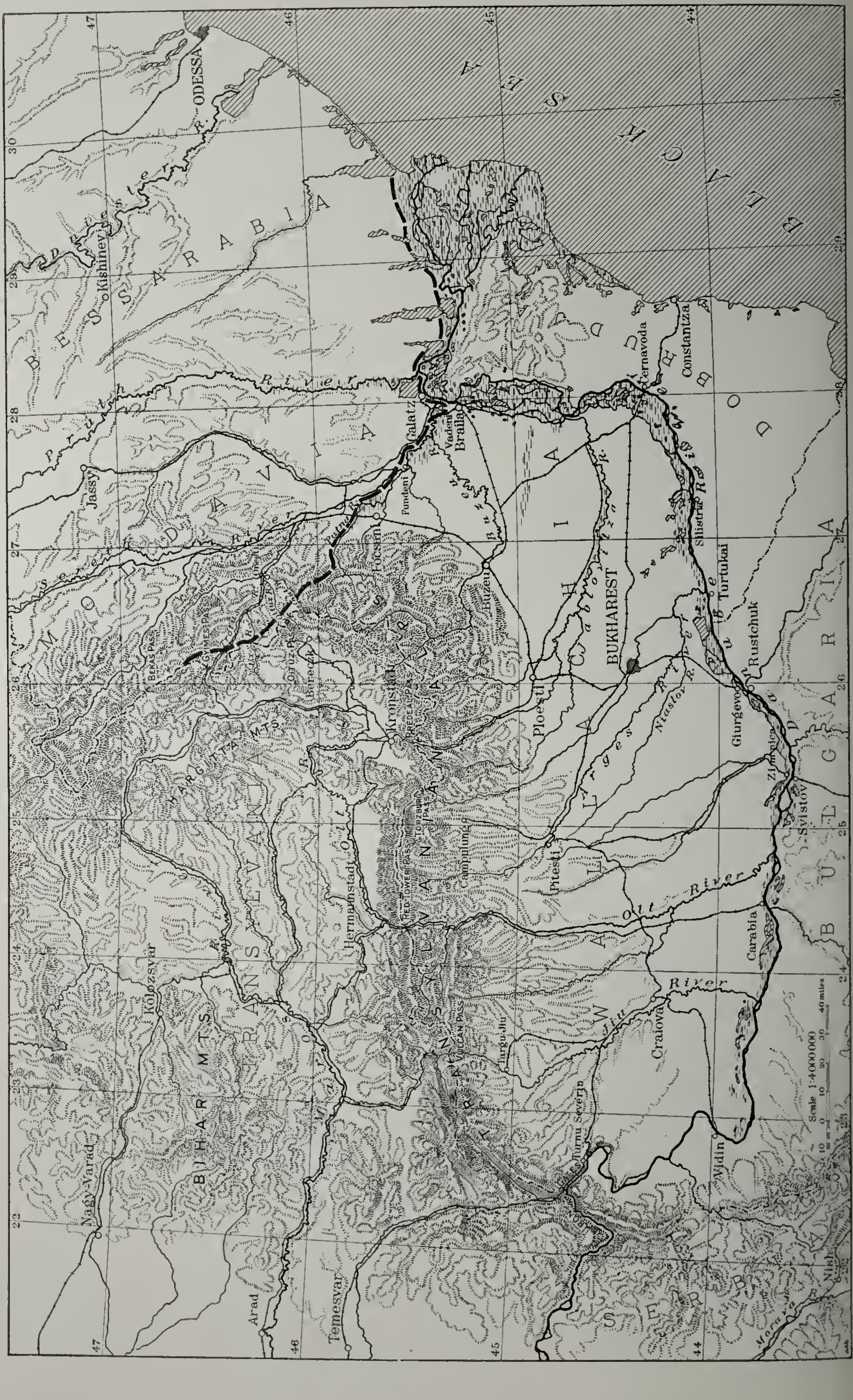

FIG. 1—Map showing the chief natural defensive barriers of Rumania. Scale, 1:4,000,000.

The use of the name Alps in connection with the Transylvanian mountains should bring to the mind of the reader the broad upland meadows from which the Alps of Switzerland get their name, rather than the rugged and inaccessible peaks which one is more apt to associate with Swiss scenery. In the Moldavian or northern part of the Transylvanian Alps the summits are comparatively low and more or less even-crested, suggesting an upwarped and dissected peneplane surface, usually less than 5,000 feet above sea level. Even here dissection to a fairly strong relief gives a rugged topography difficult for an army to traverse. Along the northern boundary of Wallachia the mountains rise to heights of 8,000 feet and over, while local glaciation has left its traces in steep-walled cirques and peaks of more truly alpine type. Broad upland remnants are nevertheless a predominant feature of the landscape, and De Martonne distinguishes several distinct erosion surfaces or partially developed peneplanes. Evidently the Transylvanian Alps must be characterized as a difficult mountain barrier, but do not deserve the adjective "inaccessible." When one remembers that they are in large part covered by forests, their difficult nature from the standpoint of military geography is better appreciated.

Nine passes of military value afford opportunity for troops to cross through the Transylvanian Alps. For strategic reasons it is preferable to consider these in three separate groups. We may denominate "the northern passes" those lying north of the great bend in the range. Farthest north is the Bekas Pass, crossed by a wagon road. At Gyimes Pass, both railroad and wagon road unite the two sides of the mountains. A good wagon road crosses through the Oituz Pass, while farther south another road or trail of inferior quality takes advantage of a less important gap. The "central passes" include two of first importance: Predeal, or Tömös, Pass, carrying the railroad and highroad from Bukharest to Kronstadt; and Törzburg Pass, crossed by a first-class wagon road. Of the three "western passes" the Red Tower Pass is the most remarkable, consisting of the deep, narrow gorge of the Olt River, cut entirely through the mountain barrier and carrying the railroad and highroad from western Rumania northward to the important Transylvanian town of Hermannstadt. Farther west the narrow gorge of the Jiu River, often referred to as "Vulcan Pass,"[2] is traversed by a wagon road alone, while the pass of the Iron Gates, cut by the Danube River, is occupied by both road and railway.

A fact of no small military importance is this: every one of the northern passes, and every one of the western passes, consists of the gorge or valley of a stream which rises on the Hungarian side of the international boundary and flows down-valley into Rumania. In other words, these passes are not

[2] The Vulcan Pass sheet of the Austro-Hungarian topographic survey shows Vulcan Pass proper on a broad, flat-topped upland forming the summit of the range, crossed by a trail a few miles west of the Jiu gorge. It is the gorge, however, which carries the wagon road, which has in fact become the real pass since the road was constructed, and which is referred to when the name "Vulcan Pass" is used in the following pages. [Cf. Professor De Martonne's paper, p. 425, above.—EDIT. NOTE.]

cols or saddles at the crest of the range, but portions of narrow valleys where these chance to be crossed by the political boundary. All of the valleys facilitate the movement of hostile troops in the easier direction, downstream, into Rumanian territory.

The Danube Valley. From the Iron Gates to a point southeast of Bukharest the Rumanian plain is protected by one of the most remarkable river barriers in the world. The Danube is in itself a great stream, half a mile or more in breadth and very deep. For much of its course it has a braided pattern, being split into two or more channels separated by intervening marshy flats. But of more importance is the broad belt of marsh and lake which borders the stream on either side, especially the northern side, and which varies in width from three to six miles, occasionally attaining a breadth of a dozen miles or more. The lakes are in part abandoned oxbow lakes and in part bodies of stagnant water filling lower portions of the backswamps or depressions between two sets of natural levees built by the river at different periods. Many lakes are covered in whole or in part by floating bogs, the broader marshes of the lower Danube, known as the Balta, being peculiarly treacherous and difficult to traverse.

Such a belt of marshy floodplain, dotted with lakes and traversed by one or more channels of a great river, constitutes a formidable barrier even in times of peace; and between Belgrade and Cernavoda, a distance of 500 miles, not a single bridge spans the Danube. Even where important railways reach neighboring towns on opposite sides of the stream, travelers must make the transfer by ferry. For military purposes the situation is only slightly relieved by the fact that occasional tongues of dry land come to the water's edge, facilitating in some small degree a forced crossing. At the most favorable places, however, no troops could force a passage in the face of an enemy equipped with proper artillery and abundantly supplied with munitions.

The Dobrudja Gateway. From the Danube southeast of Bukharest to the Black Sea the Rumanian border consists of the southern boundary of Dobrudja. This is the only significant portion of the Rumanian frontier which is not formed by some natural topographic obstacle. It is absolutely unprotected. An open plain, somewhat more dissected near the Danube, is traversed by an artificial line of demarcation which is unrelated to any topographic feature. Here is an open gateway, a hundred miles wide, through which a Rumanian army might debouch with ease upon Bulgarian lands, or by means of which Rumania might itself be readily invaded. Only an opposing army of greater strength can close such an opening against enemy attacks.

The Plans of Campaign

The geographic position of Rumania, considered in connection with the physiographic character of her frontiers, permits certain deductions

as to possible plans of campaign. In the first place, it is evident that the moment Rumania entered the war a dangerous salient was necessarily imposed upon the new Teutonic front. The Hungarian province of Transylvania formed this salient, with its apex at the great bend in the Transylvanian Alps. To crush in the sides of such a salient is a favorite military manœuver, and in the present case this might be done by Rumanian armies advanced through the northern and western passes.

Southwest of western Wallachia the Morava-Maritza trench lay not far distant, and through this trench passes a railroad of the most vital importance to the Central Powers. Some critics suggested an advance across the Danube to cut this artery of Turkish life. It will be noted, however, that Wallachia forms a salient projecting into the Teutonic front, just as Transylvania projects into Rumanian territory. Already this salient was of dangerous proportions. To increase the danger by extending the apex forty miles farther into hostile lands would invite disaster.

The open Dobrudja gateway lies much farther from the coveted Orient Railway, but the distance is not prohibitive for a military campaign of the first magnitude. Secure in the possession of the Cernavoda bridge over the Danube, supplemented perhaps by other temporary pontoon bridges, a large Rumanian army might assemble in Dobrudja and then push southwestward through the gateway. Extending its front as it advanced, it could rest its left flank on the sea, where Russian control assured a safe supply line, and its right flank on the marshy plain of the Danube. Such a manœuver possesses several noteworthy advantages: it starts with control of a safe passage of the Danube, which effectively turns that obstacle and enables the advancing Rumanians to flank the Teutonic allies out of their protected positions; it progressively straightens out the dangerous Wallachian salient; it provides a safer, if longer, advance to the Orient Railway; and it looks forward to a possible junction with Sarrail's Saloniki army and the severance of Turkey from her European allies.

Rumania did not possess sufficient troops to undertake two big campaigns at the same moment. She had to choose between the invasion of Transylvania through the mountain passes, and the invasion of Bulgaria through the Dobrudja gateway. Geographic conditions clearly demanded that she choose the latter alternative. With a minimum of troops she could hold the Teutons at bay in the narrow passes, and throw her main strength into the Dobrudja campaign, which promised such gigantic returns as the destruction of the Orient Railway, the possible capture of Constantinople, and the elimination of Bulgaria and Turkey from the war. On the other hand, an invasion of Transylvania would have only local results in the capture of certain territory and would indeed better the strategic position of the Teutonic allies by shortening their line. It could scarcely hope to eliminate any nation from the war, and could only eliminate a large fighting force in case the Teutons were unable to prevent the crushing of the

salient before their armies had withdrawn from before the central passes. While such a campaign in Transylvania was in progress, there would be real peril that a Teuton army would enter Rumania through the open Dobrudja gateway; for Rumania could hardly concentrate sufficient troops for a vigorous offensive in the difficult mountains of Transylvania, where every topographic advantage lies with the defensive, and at the same time spare the great body of troops required to block an unprotected gateway 100 miles in width.

But now there enter political considerations, the *bête noire* of the strategist. Transylvania was a lost province which Rumania was pledged by the terms of her declaration of war to redeem. Enthusiasm for the war would be aroused more by an invasion of the coveted region, than by a campaign in Bulgaria, the remoter objects of which would for a long time be obscure to the masses of the people. If Rumania invaded Bulgaria, Russia might overrun Transylvania; and Rumanians did not want Russian troops in her lost province when terms of peace were discussed. Hence came the decision which placed political considerations above considerations of military geography, and which constituted the first factor in the tragedy of Rumania.

For her part, Germany, the controlling genius of the Central Powers, permitted no political considerations to warp the plans for dealing with the Rumanian menace. She prescribed a plan of campaign which involved deliberate sacrifice of large areas in Transylvania to the impatient grasp of Rumania, and gathered strength for an assault on the Dobrudja gateway which should effectually close the way to any future menace to Bulgaria from that quarter. Let us now trace the history of the Rumanian campaign and note the rôle of physiographic features on the detailed movements of the army.

Strategic Geography of the Campaign

Promptly upon Rumania's declaration of war her troops seized the passes through the Transylvanian Alps and began the invasion of the coveted province. Columns operating through Predeal and Törzburg Passes converged on the important city of Kronstadt, while an independent column, debouching from Red Tower Pass, captured Hermannstadt. Without opposing serious resistance to the invaders, the Teutonic armies fell back toward the northwest, shortening their battle front and at the same time permitting the Rumanians to extend their thin lines of communications from the passes into the mountainous country beyond. As the Teutons fell back toward the good lateral supply line formed by the railroad and highroad traversing the Maros valley, their powers of resistance increased simultaneously with the weakening of the Rumanian offensive, especially since the Rumanians were now compelled to transport

munitions and supplies through a limited number of narrow mountain passes and far into the difficult country to the northwest.

When the advantage in favor of the Teutons had reached the desired proportions, they fell upon the Rumanian columns with overwhelming power, broke their resistance with superior accumulations of artillery and shell, and drove them back into the passes. Where opportunity offered, the thin supply lines were assailed and retreats compelled by threats to, or actual severance of, these lines. The column operating north of Hermannstadt depended upon the road and railroad through the Red Tower Pass. A small Teutonic force, operating over rough trails through minor valleys in the mountains, succeeded in reaching the pass far in the rear of the Rumanian front and actually cut the railway upon which the existence of the column depended. Abandoning large stores of supplies to the enemy, the Rumanians made a precipitate retreat, cut their way through the small flanking force, and re-established themselves in a position on the Rumanian side of the border. In a short time all the Rumanian columns were back in the passes, fighting desperately to prevent a Teutonic invasion of their own country. The unfortunate Rumanian plan of campaign had collapsed.

Meanwhile the second step of the Teutonic plan was well under way. Von Mackensen, with superior forces, entered the open Dobrudja gateway. What was his object? This was a question which claimed much attention from military critics. Some were convinced that he was chosen to deliver the death blow to Rumania by pushing northward to the Cernavoda bridge, crossing by it to the main Rumanian plain, and taking Bukharest from the east. Geographic conditions were all against such an interpretation. At Cernavoda the marshy plain of the Danube is nine miles broad and the river splits into two main channels. In addition to two long bridges over the river channels, a third bridge spans one of the numerous lakes in the marsh, while the intervening spaces are traversed by high embankments or viaducts. The so-called Cernavoda bridge is thus nine miles long, consisting of three bridge sections and two viaduct sections. Von Mackensen could not expect to capture this bridge before its destruction; its destruction could be rendered absolutely complete; and without it no safe and satisfactory line of communication over the marshy barrier was feasible. Furthermore, an attack on Bukharest from the east would necessitate a line of communication so excessively long and roundabout that the flow of shell to the battle front could scarcely be maintained at a rate sufficiently rapid to insure victory for Teuton arms. Geographic conditions imposed a supply line too long and too thin to permit a principal offensive by von Mackensen's army.

On the other hand, geographic conditions demanded an important offensive in this region for the achievement of certain necessary ends. So long as the Dobrudja gateway remained open it was a serious threat to

Bulgaria, the Orient Railway, and the continuance of Turkish support. Rumania might recover from the folly of her invasion of Transylvania, and with Russian aid undertake a belated offensive in the right direction. Teutonic armies must, therefore, close the gate. This could be done by a large force, entrenched on or near the boundary, with its right flank protected by the sea and its left by the Danube marshes. But why entrench on a front one hundred miles long when an invasion of Dobrudja, pushed only seventy miles northward, would reduce the necessary front to less than a third that length?

Dobrudja is shaped like an hour glass where the Danube River and the Black Sea coast bend toward each other. The narrowest part of the constriction lies north of the railroad which crosses the Cernavoda bridge and connects Bukharest with Rumania's only seaport, Constantza. An invasion of Dobrudja would, therefore, upset Rumanian plans for an invasion of Bulgaria, would add a certain amount of territory to the Teutonic holdings, would sever Rumanian intercourse with her Russian ally by way of the Black Sea, would result in the destruction of the only bridge which made possible an effective turning of the Teutonic positions south of the Danube barrier, and would enormously reduce the number of Teutons required to stop the gateway through which alone a dangerous Rumanian offensive could move. If von Mackensen could clear all of Dobrudja of Rumanian and Russian forces and place the barrier of the lower Danube from Galatz to the sea between himself and his enemies, he could prevent a recrossing of the river by leaving small screens of troops at critical places, and might then withdraw his main army for use elsewhere. The fact that von Mackensen, one of Germany's best generals, was placed in command of this invasion, proves that the German general staff appreciated the high importance of the move. The fact that Rumania wasted her strength elsewhere and even left an inadequate defensive force at the gateway, suggests that some one high in her authority made a fatal blunder.

Von Mackensen began the invasion by moving his principal columns northeastward close to the Danube River, possibly because the calcareous formation of the Dobrudja plain leaves little water on the surface, and water in large quantities was needed for his troops. Turtukai and Silistra were taken and their defenders captured or driven to the north bank of the Danube. On a low ridge a dozen miles south of the railroad to Constantza the Rumanian armies, with Russian reinforcements, made a stand. They succeeded in holding von Mackensen's main force in check while a violent assault on his weak right wing, nearer the sea, pushed that part of the Teuton line back to the southward a day's march. Late in October von Mackensen heavily reinforced his right wing and made a second try on that end of the battle line. The manœuver was completely successful. Constantza was captured, and the danger of an outflanking operation compelled the Russo-Rumanian army to uncover the Cernavoda

bridge. Part of the defending force apparently escaped across the bridge before it was destroyed, while the remainder withdrew into northern Dobrudja, pursued by the Teutons. After a long campaign in the more hilly country of the north, where topographic conditions prevented a rapid offensive, the last of the Russo-Rumanian troops crossed to the farther bank of the Danube, leaving the enemy in undisputed possession of all Dobrudja. The Dobrudja gateway was effectively closed and securely locked.

It should be noted that throughout the Dobrudja campaign the Teutonic armies operated with their left flank exposed to the Rumanian armies west of the Danube, and their right flank exposed to the Russian fleet controlling the Black Sea. By "exposed" is meant that, if we disregard physiographic barriers, the Teuton line was completely outflanked at both ends and its position was impossible. Only when one contemplates the security offered by the protection of a broad, marshy valley and by that of the sea, can the rôle of geography in the Dobrudja campaign be fully appreciated. Throughout much of this campaign Rumanian troops were on the Teutons' flank, far in their rear and close to their vital line of communication. Yet von Mackensen pushed his offensive secure in the confidence that the marshy Danube interposed an impassable barrier to any Rumanian attack. Only one such attack was seriously attempted. A Rumanian force effected a temporary crossing at one point where a tongue of dry land projected through the marsh to the river's edge. Unable to maintain itself with such precarious connections with the northern bank, it soon withdrew under pressure. On the Black Sea side the Russians were in control. But landing from boats in the face of a determined enemy is a hazardous operation, while supplying an invading army from the sea is almost equally difficult. Von Mackensen's flanks were in fact effectively covered by two great natural features.

While the campaign in Dobrudja was being pushed to a successful issue, von Falkenhayn was assaulting the passes of the Transylvanian Alps in an attempt to break through to the Rumanian plain. Week after week his heavy artillery thundered its demands at the mountain gateways with but slight success. The Rumanian retreat was stayed where favorable physical conditions gave excellent opportunity for an effective defense. Massed in the narrow passes, Rumanian men and guns held the would-be invaders in check.

It will be seen from the map of Rumania that von Falkenhayn might make his main attack in any one of three directions. A successful advance through the northern passes would cut the main railroad in the Sereth valley connecting Russia with her new ally, isolate all of Rumania and the Rumanian army, and probably ensure their eventual surrender. For such a campaign the Teutons enjoyed some advantages over the Rumanians. Both possessed good lateral supply lines in the shape of railways following

FIG. 3.

FIG. 4.

FIG. 3—Part of the great Cernavoda Bridge over the Danube and its marshy floodplain. (Photo copyright by Underwood & Underwood.)

FIG. 4—Watergap of a tributary to the Olt River entering the lowland between the main range of the Transylvanian Alps and the minor parallel ridges to the south. (Photo by E. de Martonne.)

close along the mountain base, but the Hungarian railway lies closer to the mountain passes than does the Rumanian line. Again, as already pointed out, the northern passes all lie east of the main divide, offering some advantage to Hungarian troops moving down hill into Rumanian territory. It appears that the Teutonic armies made violent attempts to break through one or more of these passes, but without success. Attacks at Oituz Pass seem to have been especially severe, and fear of a possible advance at this point caused the Rumanians at Gyimes Pass to withdraw some miles to avoid being cut off in case this occurred. But the retreat was only local and for strategic reasons. Whatever the other advantages favoring the Teutons, the advantage which always lies with the defensive in a difficult terrain could not be overcome.

Von Falkenhayn next concentrated large forces against the central passes. An advance over the Predeal and Törzburg cols would bring the invader direct to Bukharest and cut Rumania in half. The returns for a successful campaign by this route would not be nearly so great as in the former case, but would nevertheless be enormous. Again both sides possessed the all-important lateral railway line along the mountain base; and again the line on the Hungarian side lay closest to the passes. But again the power of the defensive in mountainous country could not be broken. Several weeks of violent assaults pushed the Rumanians back from the main col of the Törzburg Pass to a secondary position, where they held firm. At Predeal the attacks seem to have been even less successful. By the middle of November von Falkenhayn's armies had been vainly hurling themselves against the eastern and central passes for a period of six weeks. The Teuton commander was then perforce compelled to content himself with the third possibility.

The western passes offered promise of a still smaller reward, but greater certainty of at least some success. Even if these passes were forced, only a small part of the Rumanian army could be cut off and destroyed. The main force would retire on Bukharest in good order. But in favor of an attack was the highly important fact that the lateral railway at the base of the mountains on the Rumanian side did not extend to the western part of the mountains, whereas the Hungarian lateral railway did so extend. Evidently the Teutons could use their railway to mass men and munitions at the Red Tower and Vulcan Passes in overwhelming quantity, to meet which concentration the Rumanians would find themselves quite helpless. If any pass could be forced by the Teuton armies, it must be one of these two. Vulcan Pass would perhaps offer the best opportunity, since the Hungarian railway sent a branch line within a few miles of it, whereas the Rumanians had to depend on a single wagon road for a number of miles to the south. The existence of a trail across the mountains west of the Jiu gorge offered a further advantage, since by means of it a flanking force might cross the old pass on the summit and take the defenders of the gorge in the rear.

Vulcan Pass was in fact chosen for the supreme attempt. The fighting here was very severe. After being pushed southward for several miles the Rumanians assumed the offensive and administered a severe check to the invader. Reports place the Teuton loss in this engagement as 1,500 killed and a larger number taken prisoner, while their defeated armies were driven back toward the north. But shortly after the middle of November the desired concentration of guns and shell was effected, and the Teutonic offensive renewed. Unable to match the enemy's superiority in artillery fire, the Rumanians gave ground, slowly at first, then more rapidly. When pressed out of the main pass, they made a stand on the first of the secondary ridges. Defeated here, they took up their position again on the next parallel ridge. But all in vain. The stop-gap to the pass was finally pushed aside, and the Teuton flood poured into the Rumanian plain.

Immediately the entire western end of the Transylvanian Alps barrier and the western end of the Danube barrier were outflanked. With the Teutons on the open plain in their rear, there was nothing for the defenders of these natural fortifications to do except escape as best they could to the east before every avenue was closed by the advancing enemy. As it was, some 8,000 Rumanian troops were completely cut off, in extreme western Wallachia, and later compelled to surrender.

About this time it became increasingly apparent that there was a serious and unexpected shortage of munitions in the Rumanian army. The sudden collapse of the defense at Vulcan Pass and the swift, if orderly, retreat of the Rumanians throughout the following weeks could not reasonably be explained on the basis of a munition shortage due to normal difficulties of supply resulting from poor supply lines alone. In a manner the retreat resembled the great Russian retreat of a year before; but whereas the Russians turned and gave battle behind every natural defensive barrier, the Rumanians scarcely halted for engagements of any real consequence.

The solution of this mystery is probably to be found in events disclosed by the Russian revolution. Russia was, for reasons of geographical position, the power upon which Rumania necessarily depended for aid. The Russian army was willing and loyal, but the Russian government was honeycombed with spies and traitors. Trainloads of shell consigned to the army were deflected to Vladivostok and other remote points by pro-German officials high in authority. Much-needed supplies accumulated at remote depots in enormous quantities, under orders designed to render the Russian army and her ally helpless before the German assault. The great Russian retreat and the crushing of Rumania must be charged, not to the brilliant military genius of a von Hindenburg, a von Mackensen, or a von Falkenhayn, but to the treacherous pro-German government which worked untiringly to reduce its heroic armies to a state of defenselessness. It is indeed a poor general who cannot defeat an enemy previously disarmed by some one else.

Had the Rumanians been properly supplied with shell the position of the Teuton army, debouching from a single, narrow pass and dependent on a single thin line of communication, would have been perilous in the extreme. As it was, the Rumanians were unable to profit by their opportunity, and fell back to the first effective line of defense, the Olt River, a fairly broad stream which issues from Transylvania through the Red Tower Pass and flows south across the Wallachian plain to the Danube. Unfortunately, the railroad which parallels this defensive barrier lies west of the river, and would thus give a lateral supply line to the Teuton pursuers, while the Rumanians would have no equivalent advantage. This alone was enough to render the line of the Olt of doubtful value. Aside from this consideration, it was questionable how long the Rumanian forces could hold the line under heavy Teuton fire when they themselves were unable to reply in kind. The issue was promptly settled, however, when von Mackensen, profiting by the Rumanian shortage of munitions, effected a passage of the Danube under cover of superior artillery fire at Zimnica, 30 miles east of the lower Olt. This manœuver completely outflanked the whole line of the Olt, and the Rumanian army fell back toward the east.

The Wallachian plain is in large part an alluvial slope underlain by sands and gravels deposited by streams issuing from the Transylvanian Alps, and is traversed by the extensions of these rivers, roughly parallel to the Olt but swinging more toward the east in their lower courses. As the Rumanian armies withdrew from the line of the Olt they fought brief delaying actions along one and another of the parallel streams. Thus we hear of them deployed along the Niaslov River, and later find them fighting a vigorous action along parts of the Arges. This latter river was expected by many to form the defensive screen for the capital, Bukharest. It is, however, poorly adapted to such a purpose. A railroad parallels it on the side next the city, which is as it should be; but the stream is not large, it lies too close to the city in its lower course, and its direction, strongly southeast, facilitated the outflanking of the defenders by an enemy force advancing eastward after capturing Pitesti and crossing the stream near its headwaters. None of the parallel rivers is supplied with broad belts of marsh, which alone render streams of moderate size really formidable military barriers.

After abandoning Bukharest the Rumanian forces retired northeastward, constantly swinging around more and more to the north as required by the shape of the country between the parallel bends of the Transylvanian Alps on the northwest and the Danube on the southeast. To accomplish this the Rumanian line, now strengthened by a large force of Russians, must pivot on its right wing, marking time there until the left wing, down near the Danube, could swing through a great arc and reach its appointed position. This was a difficult manœuver, made possible by the fact that the country increases in ruggedness toward the pivoting point. The

Rumanian right wing held the Teutons at bay in the mountains, while the left retired swiftly across the smooth plain.

During this part of the retreat we hear of a brief delaying action along the course of the Jalomitza River, and of a longer one at the Buzeu River. The Jalomitza is paralleled on its northern side by a railway which would afford the defenders a good lateral supply line, and the river with its more or less marshy flood plain is a protective screen of some value. It would appear that this line was outflanked, however, when the Teutons crossed the small headwaters near Ploesti, captured that town, and pushed on toward the town of Buzeu. One military critic based his discussions for some days on the thesis that the main defensive line to which the Rumanians were withdrawing was the line of the Buzeu River. Geographic conditions are distinctly against this thesis. The river is of fair size, but its course would permit a dangerous outflanking move toward the east where the course of the stream bends far to the north. The barrier is not sufficiently formidable to justify an attempt to hold its southwestern sector after other troops had reached its northeastern portion, 30 to 40 miles in the rear of the first position. A former course of the river, leading more directly eastward to the Danube and now occupied by marshes and lakes, might make a better line so far as direction is concerned; but it is not a barrier of serious proportions. Another reason why the Rumanians could not stand on the Buzeu line is found in the position of the railway, which parallels the stream on the southern side, thus affording a lateral line of communication for the enemy. With such an advantage the Teutons could quickly distribute men and artillery to any chosen point on the line and pierce it; while the defenders, lacking lateral communications, could offer but feeble resistance. The same objection applies to the so-called Sereth-Trotus line, selected by the same critic as the main defensive position after the Buzeu line had been passed. Both on the middle Sereth and the Trotus the railway is on the wrong side of the river. It would seem as though the railroads had been placed with reference to a foe expected from the northeast rather than from the west.

After a sharp contest on the Rammic River the Russo-Rumanian forces took up their final stand behind the line of the lower Sereth and Putna Rivers. Inasmuch as some critics were convinced that no attempt would be made to hold the Putna line, and since furthermore the Teutonic pursuit was in fact brought to a complete check along this line in spite of desperate fighting, it will be worth while to examine the physiographic characteristics of the Putna and Sereth valleys with some care.

The Putna River rises near the great bend of the Transylvanian Alps and flows in general southeastward across the plain to join the Sereth between the towns of Focsani and Galatz. Before leaving the mountains two main headwater branches of the stream flow toward each other along the pronounced lowland already described as extending parallel to the main

crest, and unite to form a single river which has cut a transverse gorge through the first and most prominent of the secondary parallel ridges. In this region the Rumanians have utilized the secondary ridge, which rises 1,500 feet above the adjacent valley, as their natural defense.

After leaving the foothills, the Putna, still a stream of but moderate size, has a marshy floodplain from one-third of a mile to more than a mile in breadth. In the vicinity of Focsani the marshes widen out to a breadth of several miles, but just below there begins a stretch of dry land which continues to Fundeni, and which would facilitate a crossing by hostile troops. Fortunately, it is just here that the Sereth flows parallel and close to the Putna for some distance, reinforcing the latter by a really formidable obstacle. At Fundeni, however, there is neither marsh nor a double river barrier. Of all points on the Sereth-Putna line Fundeni appears to offer the best opportunity for an enemy crossing. The town lies on the north bank of the Sereth within a meander loop which projects southward. This would expose the town to a converging fire from three sides, and thus still further facilitate a crossing by hostile forces. It is true that there are some points favorable to the defense. The river at this point is nearly a quarter of a mile broad and too deep to ford. A number of old oxbow lakes on its southern side afford some additional protection. The great marshes of the lower Sereth begin close to the downstream side of the meander, rendering it difficult for an enemy to develop the full force of a converging attack. But since the marshes just referred to continue in a broad belt to the Danube at Galatz, and the Danube from Galatz to the Black Sea is an impassable barrier of distributary river channels on a marshy delta dotted with lakes both large and small, it must still appear that the Fundeni sector is from its physiographic character the point where enemy attacks should most confidently be expected.

We have seen that the Sereth-Putna line is a defensive barrier of some degree of formidableness. An examination of the railways in this region shows that the line is supplied with lateral communications well adapted to deliver shells, supplies, and reinforcements to the defenders, wherever need should arise. The Sereth is paralleled by a railway from Galatz to the mouth of the Putna. The main central railway of Moldavia, over which Russian reinforcements must largely come, leads up to the center of the Putna defensive line, while a lateral branch connects this main railway with the one paralleling the lower Sereth. The extension of the Putna line along the secondary ridge and thence northwest past Oituz Pass and Gyimes Pass is paralleled by the Trotus valley railway. All these railways, it will be noted, are on the north of the defensive barrier, and so protected by it from hostile attack. This alone would be sufficient to explain why the Sereth-Putna line is superior to the Sereth-Trotus farther north, or the Buzeu line farther south.

The Teutonic armies arrived before the Sereth-Putna line during the

first week of January, 1917. They first tried to force the marshes of the Putna River north of Focsani, at the end of the railway and highroad along which one of their main columns was advancing. At one time, under cover of a fog, some Teuton troops gained the northern bank of the river but were quickly driven back. A second attempt was made near Galatz, in the hope of turning the left flank of the defensive line. After capturing Braila, a Teuton column struggled painfully along the railway embankment which crosses the marshes to Vadeni and the bridge over the lower Sereth. Many days of heavy fighting resulted in the capture of Vadeni, but it proved impossible to manœuver to advantage in this region of marshes. The crossing of the river could not be effected, and Vadeni was soon recaptured by a Russian advance guard.

By this time troops and supplies had been assembled for a violent assault on that part of the line offering the best chance of a successful crossing. Advancing over the dry ground toward Fundeni, the Teutons launched an offensive at the town shortly after the middle of January. The importance of this attack may be gauged from the fact that the best Prussian troops in the Teuton armies were thrown into the fighting. Day after day the struggle dragged on, and still the river barrier barred the way to Teuton ambition. February found the baffled armies of the Central Powers still fighting to cross the barrier, and the world began to realize that the marshy valley of the Sereth and Putna constituted a military obstacle of commanding importance.

While suffering defeat in every attempt to turn the left wing or to break through the center of the Sereth-Putna line, the Teutons were not idle up in the mountains, where a successful advance would turn the right of the line and flank the defenders out of the entire position. For more than a month a colossal effort was made to break through the Oituz Pass. To understand what success in this endeavor would mean, one must carefully note the pattern of the valleys in the vicinity of the pass. In the upper Trotus valley four branch ravines, converging upon the town of Onesti, have more or less practicable passes near their heads. Thus the upper Trotus itself heads in Gyimes Pass and carries a railroad and highroad; the upper Uz heads in an unimportant pass through which there runs a trail; the upper Oituz forms the Oituz Pass, which has a good wagon road; and the upper Casinul starts at a minor pass provided with a trail.

Now it is clear that if the Teutons succeeded in forcing any one of these passes and reached Onesti, the trunk supply line would be cut and the forces defending the other passes would be trapped. But this is not all; for once the four passes were thrown open by such a successful manœuver, and a Teuton army concentrated in the Trotus valley, backed by three good supply lines (a railroad and two wagon roads) through the Gyimes and Oituz Passes, nothing could check a Teuton advance down valley to its junction with the Sereth. This would take in the rear all the northwestern

extension of the Putna line and would cut the central Moldavian railway, the vital artery upon which all the rest of the Putna line depends. The moment this main railway was reached, a retreat to the northeast, behind the middle Sereth River, would be forced. In other words, a success in one of the passes at the right of the Sereth-Putna line would outflank practically the entire position.

No wonder the fighting at Oituz Pass occupied the attention of the world for a number of weeks! Four Teuton columns entered the heads of the four branch valleys and all fought desperately to reach Onesti. The advance through Oituz Pass seemed to promise the best advantage to the Teuton offensive, and would reach the Trotus valley railway only a few miles from the crest of the range. But the power of the defensive, blocking the narrow valleys, was too great. The column in the Casinul valley got within ten miles of its objective when it was thrown back. The other columns were even less successful. A furious attack on the secondary ridge farther southeast fared no better. Every attempt to reach the Trotus valley railway failed. The difficult mountain topography prevented the turning of the Sereth-Putna line on the right just as effectively as the marshes near Galatz prevented the turning of the left.

The Rumanian campaign, beginning on the defensive line of the Transylvanian Alps and Danube marshes, ended on the defensive line of the northern Transylvanian Alps and Sereth-Putna marshes.

A DECADE OF THE SALTON SEA

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Extending from the lower course of the Colorado River in a north-northwesterly direction to San Gorgonio Pass, the longitudinal depression between the San Bernardino and the San Jacinto Ranges through which the Southern Pacific Railway runs to the coastal lowland of Southern California and its metropolis Los Angeles, lies a wedge-shaped basin, 185 miles long, generally known as the Cahuilla Basin. Its apex lies to the northwest; on its two long sides it is bounded by mountain ranges: on the northeast by the San Bernardino Range, the Chuckawalla Mountains, and the Chocolate Range, which separate it from the Mohave Desert; on the southwest, by the San Jacinto Range, the Santa Rosa Mountains, Superstition Mountain, and the Cocopah Mountains, the last of which separate it from the Pattie Basin, a similar depression, bounded on the west by the Peninsula Range of Lower California. In longitudinal profile the Cahuilla Basin is spoon-shaped, with the bowl to the southeast and the stem to the northwest. The rim of the bowl is formed by the delta of the Colorado River, from which the floor slopes down to 265 feet below sea level in the part nearest the stem. It is here that the Salton Sea lies.[1]

Variable quantities of flood waters have at intervals of a few years escaped from the main or effluent channels of the delta of the Colorado River and flowed down the slopes of the basin, sometimes collecting as a series of pools or lagoons at the bottom and at other times making the body of water which has been in recent times known as the Salton Sea. If the inflow continued until it overflowed the lower part of the delta which separates the basin from the Gulf of California, an area of about 2,200 square miles would be covered and the shores of the lake would be something like twenty feet above the datum taken as sea level by the U. S. Geological Survey, the bottom of the basin lying 274 feet below.

The general consensus of the physical and biological evidence is to the effect that three or four centuries have elapsed since water rose in the basin to the highest level. The number of times the lake has reached the

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[1] Cf. Reconnaissance Map of the Salton Sink, California, 1:500,000, U.S. Geol. Survey, Washington, 1906.
Relief Map of the Lower Colorado River, Showing Irrigable Lands in the United States and Mexico, January, 1905 [photograph, 1:1,250,000, of a relief model]. Accompanies "The Salton Sea" by F. H. Newell, *Ann. Rept. Smithsonian Inst. for Year Ending June 30, 1907*, pp. 331-345.
Map of the Desert of the Colorado, compiled by G. Sykes [1:800,000], Pl. 2, "The Salton Sea: A Study of the Geography, the Geology, the Floristics, and the Ecology of a Desert Basin," by D. T. MacDougal and collaborators, *Carnegie Inst. Publ. No. 193*, Washington, 1914.
Map of the Delta of the Colorado River, Including the Salton and Pattie Basins, compiled and drawn by Godfrey Sykes [1:1,500,000]. Accompanies "The Desert Basins of the Colorado Delta" by D. T. MacDougal, *Bull. Amer. Geogr. Soc.*, Vol. 39, 1907, pp. 705-729.

maximum is not clear; some writers are disposed to favor the inference that it stood so high but once in its history and then perhaps for less than a century. Loss by evaporation in this region is such that of a possible total of 116 inches, a layer of 40 to 60 inches passes off in vapor every year. If the lake were filled to its high level by a single flood, and thereafter received nothing but the drainage of the surrounding slopes, nearly a

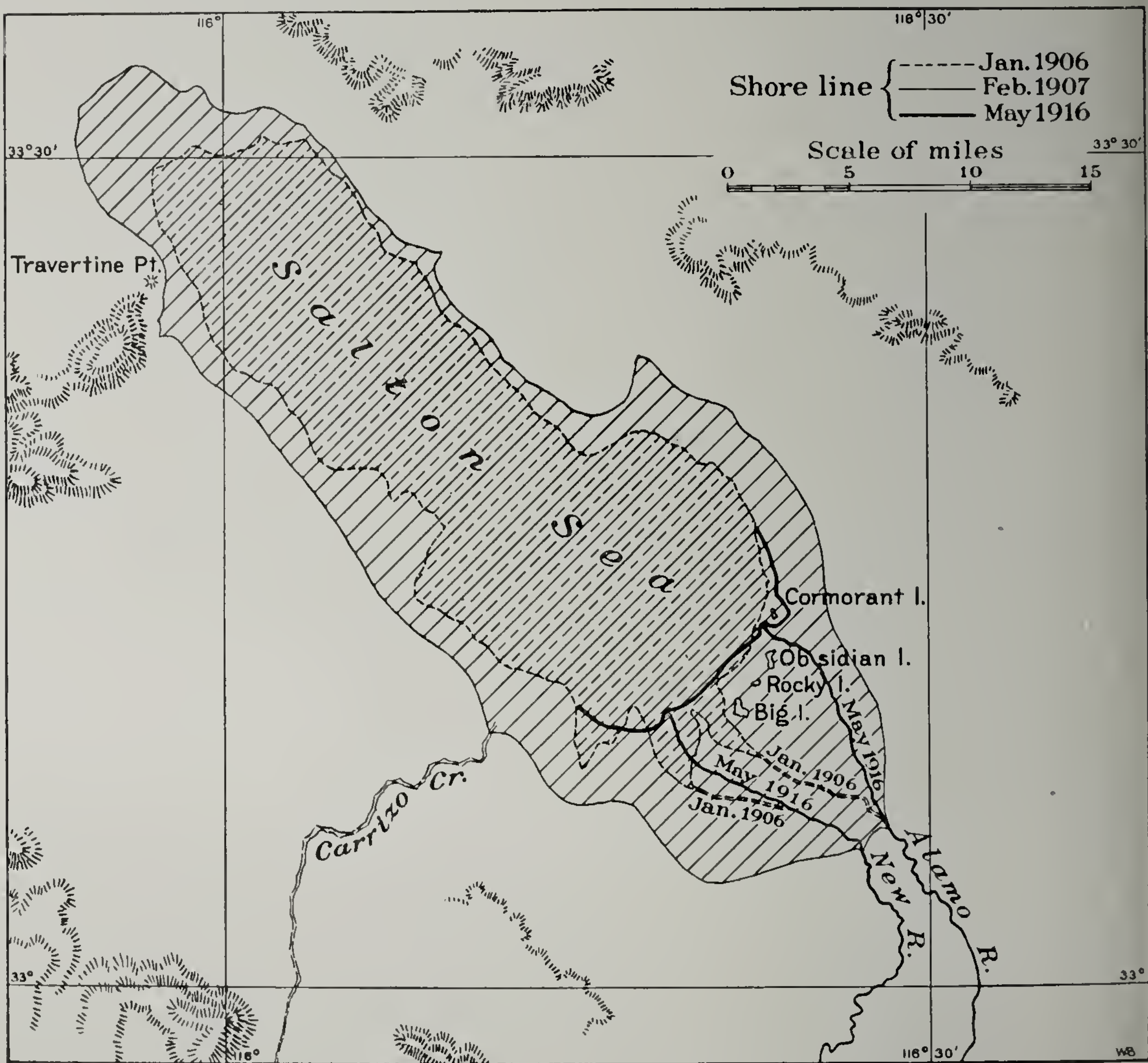

FIG. 1—Sketch-map of the Salton Sea showing levels of January, 1906, and February, 1907, and position of delta and lower course of the New and Alamo Rivers in May, 1916. Scale 1:650,000. (January, 1906, shore line based on "Reconnaissance Map of the Salton Sink, California," 1:500,000, U. S. Geological Survey, Washington, 1906.)

century would elapse before it dried up to leave the white saline beds on its bottom.

The earliest notice of floods escaping into the basin is of 1840, followed by others of 1842, 1852, 1859, 1862, and 1867, and but little is known of the body of water accumulating in the basin in each case. A notable inundation occurred in 1891, when the water came near the line of the Southern Pacific Railway and a representative of a newspaper followed a stream of water from the main channel of the Colorado River down into

the lake itself. These occurrences within recent time are probably continuous with the earlier history of the basin.

When a lake has once been made, its recession is a halting one, with many partial returns toward the maximum level and perhaps a few actual refillings. However this may have occurred, the heavy deposit, formed on the rocks which were a few feet below the surface at the high level, yields irrefutable evidence that either in one period or in several periods the lake stood full or nearly so for a time sufficient for the organic formation of a travertine layer one to three feet in thickness. The halting and irregular recession of the lake is finely recorded in the terraces which are formed when the water stands a few months at any given level. The upper two hundred feet of a gravelly slope near the railroad station of Salton shows 83 of these shelves or benches of assorted material, as has been determined by Professor Ellsworth Huntington and the writer. The terraces remain as one apparent series, however, and no means has yet been found for distinguishing between those of an older lake on the higher slopes and more recent benches near the bottom resulting from the action of a smaller lake.

The conclusions as to the oscillation and refilling of the lake were therefore based simply on allowable assumptions until early in 1915, when a discovery was made which placed the matter on a basis of record of some historical value. In the tufa coating on an outlying mass of fragmented granite projecting into the southwestern side of the Cahuilla Basin a number of carved designs of Indian origin were found by us in 1906, and had probably been seen by earlier visitors to the place. The formation is designated as ''Travertine Rock'' and ''Travertine Point'' in our various publications. The crest rises a few feet above the maximum level of the lake and would have showed as a small rocky islet. A few feet below high-water mark the deposit of tufa reaches a thickness of several feet. Below this the tufa or travertine is not so heavy, thinning down to a few inches near the base of the granite mass. Now this tufa is a lime formation which is made only in fresh or slightly brackish water, and as it seemed highly probable that the occurrence of the carvings might yield some evidence on the history of the lake, a special visit was made to this place in company with Mr. Godfrey Sykes in March, 1915, for the purpose of making a more careful examination of the formation. The half-light of a cloudy day was favorable to the discovery of a large number of carved figures. Some of these showed as deep furrowings visible at a hundred yards, and others were so faint as to be barely discernible (see Fig. 5). Cuttings made through some of the lines showed that none of the carvings had been made in the granite but were chipped in the travertine deposited on it. Next it became clear, upon examination of polished slices of the rock, that some of the cuttings had been subsequently coated with additional layers of travertine. This would indicate that after aboriginal man came into the region and acquired the art and habit of making such figures, he frequented

FIG. 3—Terraces formed by the lake in the winter of 1915-16. Strand of 1915, devoid of vegetation, on the left; water receding from the terrace on the right. May, 1916.

this bold foreland and cut his symbols of lightning, of storms, and of the serpent; then the lake rose and coated them over. With its recession a few years or a century later, the place making its natural appeal to the primitive mind as suitable for records, other carvings were added from time to time. Much importance must have been attached to recognizable figures uncovered by the lake. It is notable, however, that none of the figures were made in the present surface of the travertine, a condition paralleled by series of carvings in many places in Arizona. Whatever may have been the reasons for the discontinuance of the making of figures on any ordinary "pictured rocks" it is clear that a full lake came after all made on Travertine Point. After these undated records of the aborigines came the explorer, and the hope still survives that the records of the Spanish expeditions of the sixteenth and seventeenth centuries may yet yield some notes as to this region, in addition to Rocque's map of the eighteenth century.[2]

The influx of a body of fresh water into a saline basin which in ordinary times was a desert of a very pronounced type might be expected to be accompanied by serious disturbances of the physical conditions, which would be reflected in the behavior and geographical relations of the plants and animals of the region. This may be best understood when the topographical and meteorological conditions are recalled. The basin is subject to a mixed type of climate. It lies far enough inland for overheating to result in a continental type of climate, particularly with respect to the rainfall. Its great bowl, however, lies immediately in the lee of a great mountain range which rises abruptly from its southwestern side, with the result that fringes of mountain storms reach out over part of its area at times, while the topographical conditions favor the development of the intense and localized precipitation known as cloudbursts.

The annual average rainfall from data covering thirty-six years is 2.74 inches, and the character of the precipitation phenomena suggests a high degree of aridity. The maximum amount of rain received in one year was 7.10 inches (1906) and the lowest, a "trace" (less than .01 inches), in 1904, giving a variation as 1 to 1,000, a proportion occurring in deserts of a pronounced degree of aridity only. Another method of characterizing deserts according to their aridity is to give the ratio of possible evaporation from a free-water surface to the annual amount of precipitation. In the Cahuilla Basin about 116 inches of water would evaporate during a year from the surface of a small vessel on the ground in the open; this is fifteen times the amount which has fallen in any one year; forty-three times the average, and many thousands of times the minimum. The region is in fact a desert of the most advanced type, in which desiccation has progressed to such an extent as to reduce the native flora to less than 140 species of seed plants.

The setting and the constructive arrangement for an experiment which

[2] See Pl. 2, *Carnegie Inst. Publ. No. 193* (title cited in footnote 1).

would test the effects of a body of fresh water on the native organisms of such a desert were made when a company, organized for the purpose of irrigating an area in the basin, began "the task of connecting and clearing the various channels which formed the natural waterway between the river and the basin; and by the middle of 1901 water was flowing upon the irrigable lands of what has since become known as the Imperial Valley. It had been deemed advisable by the promoters of the scheme to take the water from the river in United States territory, and so the upper section of the canal was cut almost parallel to the river for several miles and with a very low gradient. This circumstance, together with the general unsuitability of the site selected for the head works, caused considerable trouble for two or three years, as more and more water was required to fulfill the demands of the growing communities in the desert; and so various openings were made between the river and the canal in order to furnish a more adequate supply.

"Then, in the winter of 1904-05, one of the infrequent winter floods in the Colorado, coincident with a tremendous rush of storm waters from the Gila, found before itself the unprotected head and comparatively steep downward grade of the canal, and at once began to cut and enlarge the channel. The ordinary summer flood of 1905 also poured its water through the opening, and it was soon realized that the outpour had got beyond control.

"Practically the whole of the Colorado was now flowing into the Salton Basin, and another flood in the following November (1905) made the task of closing the breach seem almost hopeless, although the most strenuous efforts were being made by the engineers; and it was not until February, 1907, that the Colorado was finally returned into its former channel."[3]

The lake formed had a depth of from 80 to 85 feet, and the total area of this latest Salton Sea was estimated at from 450 to 500 square miles (see map, Fig. 1).

Field plans of the Desert Laboratory staff for the study of the surface phenomena of arid regions were put into final form in 1906, and the Salton Sea offered an unexampled opportunity for the measurement of its recession and the observation of the accompanying successions of vegetation from aquatic to desert conditions.

The actual number of species of plants native to the Cahuilla Basin comprises less than 140 ferns and seed plants, of which five, or three per cent of the whole list, are endemic and the greater number are suitable for existence in saline soils. The influx of the flood waters brought the seeds of a large number of species of land and shore plants from along several hundred miles of the Colorado River, and these, together with the seeds which had been floated from the dry slopes of the basin, were cast on

[3] D. T. MacDougal: The Salton Sea, *Amer. Journ. of Science*, 4th Series, Vol. 39, 1915, pp. 231-250; quotation on p. 235.

Fig. 4.

Fig. 5.

Fig. 4—Salton Sea: dense vegetation on beaches of Obsidian Island, strands of 1907 to 1912.
Fig. 5—Figures in the travertine on Travertine Point.

Fig. 6.

Fig. 7.

Fig. 6—Delta of the New River. Effluent leading off to the right one-fourth of a mile to the margin of the lake. May, 1916.

Fig. 7—Channel of the Alamo River above recent high level of the lake, carrying average flow into the lake. May, 1916.

the moist shores of the lake. The water remained practically stationary at its highest level but a few hours, and then the loss by seepage and by evaporation was so great that the margin receded several feet per day on the gentler slopes, so that in some places around the southeastern end of the lake a strip a mile or more in width was laid bare in a year. This emersed strip of 1907, having been washed by the water in its freshest stage, was sown with the seeds, including the greatest number of species possible under the circumstances, with the result that in the cooler season at the end of this year dense ranks and belts of vegetation occupied the shores much as if the lake were of fresh or brackish water, and these zonal formations included the greatest number of species yet seen about it. In the succeeding years the water was a more concentrated solution of the contained salts, the supply of seeds from the river was cut off, and consequently the beaches, now increasingly salty, were less richly sown each year, with the result that by the spring of 1916 only a few species appeared on the shores recently abandoned by the lake. This fact was taken to mark the end of the first stage of the recession of the lake and concluded a period in which the muddy shores were at first occupied by ordinary land species, some of which failed to appear in the succeeding years, until at the present time only pickleweed *(Spirostachys occidentalis)*, seablite *(Suaeda torreyana)*, sea-purslane *(Sesuvium sessile)*, salt bush *(Atriplex canescens)*, and beach-heliotrope *(Heliotropium curassavicum)*—species common to saline shores and salty areas—come on the beaches. The newly emersed strips were occupied during the first year in the earlier stages of the lake, but now only a few plants come in until the soil has been bare for a year. It is probable that one of the factors in the matter is that of the oxygen in the soil. The ground now being laid bare is closely packed and saturated, and the pioneer species cannot grow in it until some aëration has taken place (Fig. 4).

The definite close of the cycle in pioneer occupation has also called attention to another phase of the vegetative phenomena, that of the successions or changes on the emersed beaches. It is easily to be understood that the plants which came in on the moist belt of land from which the lake receded in 1907 could not maintain themselves indefinitely in that place. The original supply of moisture not being replenished in any adequate manner, the fresh-water pioneers slowly succumbed to increasing desiccation, which in turn offered favorable conditions for desert species. The succession or changes from the condition of close-ranked moisture-requiring species to that of the open formations took place so rapidly that the nearly static condition of the latter might be reached in a half-dozen years or even less. In fact many square miles of territory submerged in 1906 and 1907 have now returned to the desert conditions previously prevalent (Fig. 3).

The conditions of salinity in the water of the lake have likewise made

a similar succession, but for the most part of organisms not visible to the eye. The water at the maximum level of the lake contained about one-third of one per cent of dissolved matter, and its use as drinking water was a matter of friendly competition among the members of the exploring party who circumnavigated the lake at this time and the results were given in our publication on this subject as follows[4]: "The water at this time [February, 1907] contained about 0.25 per cent of dissolved salts, which is near the limit of potability. This was denoted by the fact that it could be used by some members of the party, but not by others."

Potability is in itself a very uncertain feature of waters in desert regions, as has been most adequately set forth by Phillips as follows[5]:

> "Drinking water" is a *façon de parler* in the desert. Threepennyweight of salt to the quart [about .5 per cent] is enough, as the reader will find if he tries, to give it a strong briny flavor. Such water, however, is freely drunk in the Sahara. Horses, camels, and donkeys even thrive on water containing nearly half an ounce of salt to the quart. It varies very much in different neighborhoods, but is always distinctly brackish and generally impregnated besides with potash, magnesia, sulphuric acid, and other delicacies, to such an extent that the old custom of poisoning the wells always struck me as a very superfluous one.
>
> All things, however, adapt themselves to it. Water that will appease the thirst of an Arab would only aggravate that of a European.

The facts and the cited comment are given place, since a reviewer has made the statement that no reference was made to the potability of the water in the Salton volume.[6]

The results of the annual analyses incorporated in the table on page 468 were carefully scrutinized every year for the purpose of detecting changes in the composition of the water which might be correlated with the behavior of the plants affected by the water. During the first year of the recession of the lake the chief mineral constituents increased so that the amount present was about 19 to nearly 21 per cent greater in 1908 than in 1907. This increase was shared by the calcium. In the following year, while the sodium increased 19.4 per cent and the potassium 16.5 per cent, calcium increased but 7 per cent and in the following year but slightly more. Coincidently the missing calcium was found as a lime deposit on the branches of submerged shrubs, stones, and other objects. The amount of calcium in the solution had by no means reached the saturation point. and other causes must be brought in to account for the deposition. The above applies also to some extent to the course of concentration of the magnesium. The only available inference is that the lime and magnesia were being brought down by the action of a plexus of algae and bacteria. The inferred presence of these organisms would carry with it the implication that the formation of the lake would be followed by their multiplica-

[4] *Carnegie Inst. Publ. No. 193*, p. 117.

[5] L. March Phillips: In the Desert and the Hinterland of Algiers, London, 1909, pp. 184 and 185.

[6] See Mark Jefferson, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, p. 885, who says in a review of "The Salton Sea": "We do not learn whether the Salton Sea was, or is now, drinkable."

Ten Complete Analyses of the Salton Sea Water

	Parts per 100,000									
	June 3, 1907	May 25, 1908	June 8, 1909	May 22, 1910	June 3, 1911	June 10, 1912	June 18, 1913	June 12, 1914	June 8, 1915	June 10, 1916
Total solids (dried at 110° C.) plus water of occlusion and hydration	364.8	437.20	519.40	603.80	718.00	846.55	1002.56	1179.6	1377.4	1647.2
Water of occlusion and hydration	....	....	17.50	22.56	20.84	23.9	32.6	36.2	42.2	47.5
Sodium, Na	111.05	134.26	160.33	189.28	227.81	270.71	323.08	381.47	441.6	528.9
Potassium, K	2.30	2.78	3.24	3.53	3.81	3.81	3.45	4.01	5.2	5.71
Lithium, Li	trace	0.013	0.017	0.021	0.025	....	....	....	....	....
Calcium, Ca	9.95	11.87	12.70	13.67	15.62	17.28	19.75	22.22	25.27	29.85
Magnesium, Mg	6.43	7.63	8.96	9.84	11.68	13.62	16.22	19.03	22.63	27.17
Aluminum, Al	0.030	0.035	0.062	0.040	0.089	0.100	0.125	0.140	0.032	0.034
Iron, Fe	0.005	0.006	0.010	0.008	0.036	0.042	0.038	0.012	0.020	0.060
Silicate radicle, SiO_4	1.41	1.43	1.59	1.55	1.83	1.79	2.18	2.42	1.55	1.21
Manganese, Mn	....	....	....	....	....	....	....	....	....	....
Lead, Pb	....	....	....	....	....	....	....	....	....	....
Copper, Cu	....	....	trace	trace	trace	....	....	trace	....	....
Chlorine, Cl	169.75	204 05	240.90	280.93	339.42	395.44	473.89	559.66	650.95	787.64
Bromine, Br	....	....	....	....	...	....	....	....	....	....
Iodine, I	....	....	....	....	....	....	....	....	....	....
Sulphate radicle, SO_4	47.60	56.74	65.87	76.36	91.67	106.83	124.65	148.10	174.47	207.89
Carbonate radicle, CO_3	6.58	7.66	7.34	6.38	5.78	12.09	11.28	10.96	11.92	11.40
Arsenate radicle, AsO_4	....	....	....	....	....	....	....	....	....	....
Phosphate radicle, PO_4	0.009	0.011	0.01	0.013	trace	trace	trace	....	....	doubtful
Nitrate radicle, NO_3	0.18	0.20	....	....	....	trace	....	....	....	....
Nitrite radicle, NO_2	....	....	0.0006	....	....	....	....	....	....	trace
Oxygen consumed	0.093	0.059	0.068	0.045	0.063	0.072	0.110	0.110	0.208	0.170
Borate radicle, BO_2	....	trace	trace	trace	trace	....	trace	trace	trace	trace

tion and development, which was such that the maximum formation of tufa or lime deposit was greatest in 1909 and 1910, during which period the amount thrown down was sufficient to account for about half of the expected increase in concentration of lime. In succeeding years this action was not so marked.

It is notable that the travertine deposit on the slopes of the basin is of a parallel nature. The heaviest deposit is a few feet below the maximum level of the lake and then thins down toward the bottom. The decrease in deposition does not coincide with a poverty of material and may therefore be reasonably ascribed to a modification of the activities of the organisms. Thus, while some calcium and magnesium is being lost from the solution, it now no longer comes down as coatings on objects in place, and it probably settles in the form of minute particles, although the almost ceaseless motion of the water prevents it from forming a definite and visible layer.

A somewhat similar fluctuation of the potassium in the water is as yet unaccounted for. Thus no increase of this element occurred in the year ending June, 1912, and an actual decrease followed.

Any discussion of the influence of the lake on the surrounding region would be incomplete without the mention of the fantastic popular notion that the climate hundreds of miles away was modified by its tempering action. The presence of the lake, of course, implies a blanket of vapor pressed shoreward by the prevailing winds, and it was obvious that the heightened humidity did exercise an effect on vegetation within a few hundred yards of the shore.

The most marked effect on the vegetation of areas not actually affected by the submergence was that resulting from the checked underflow from the mountain slopes on the southwestern shore of the lake. The water thus prevented from escaping to lower levels accumulated and was forced so near to the surface as to be available for plants, which showed a luxuriance much beyond that prevalent in the empty basin.

Somewhat sensational is the emergence, after the recession of the lake, of the mud volcanoes which lie on the northeastern slopes of the basin near some hills which have become islands. These vents were covered with water in 1907, and, although the course of sail boats and launches was laid over them, nothing was seen of them until late in 1915, when they began to boil up irregularly through the water when it came down to a depth of five or six feet, sometimes throwing a mass of mud several feet above the surface. Vents entirely uncovered resumed activity in boiling pools, with a notable emission of gases (Fig. 8).

Four volcanic hills lie on a north-south axis in the southeastern part of the basin. The summits of three of these remained above the level of the water in 1907, and the occupation of the beaches around these islands by vegetation has been described in detail elsewhere[7] (see also Fig. 4).

[7] *Carnegie Inst. Publ. No. 193*, p. 125 ff. and 168 ff.

[illegible] in the strand laid bare in 1915 through the recession of the lake. May, 1916.

Wind-borne seeds and floating seeds, root-stocks, and seedlings found lodgment on the moist strands, resulting in a series of successions not essentially different from that on the main shores of the lake. These three higher hills have now become joined to the mainland.

The smallest hill of the group, however, was so nearly covered by the floods that its summit was repeatedly washed by the slightly salty water in 1907, and it was therefore considered as sterilized of all of the seed plants. Its emersed portion, which was designated as Cormorant Island, offered an unusually interesting area upon which the occurrence of plants could be followed with some exactness. Two miles of water separated it from the nearest island, and in 1908, at which time the first two individual plants were found, six or seven miles of water separated it from the main shore. These two pioneers were "arrow-weed," *Pluchea sericea,* and *Baccharis glutinosa.* The census of the plant population of the island was taken again in 1912 and in May, 1916, the analysis of the population being as below:

REVEGETATION OF CORMORANT ISLAND

	Number of individuals		
Eleven Species	1908	1912	1916
Atriplex lentiformis	..	5	35
Baccharis glutinosa	1	2	..
Cryptanthe barbigera	..	..	1
Distichlis spicata	..	..	1
Erigeron canadensis	..	..	2
Heliotropium curassavicum	..	2	15
Lactuca asper	..	..	2
Pluchea sericea	1	2	4
Rumex berlandieri	..	..	1
Sesuvium sessile	..	2	5
Spirostachys occidentalis	..	20	404
Total— 2 species	2	..	..
Total— 6 species	..	33	..
Total—10 species	..	..	470

The total number of species now occupying the island is probably as great as when it was a desert hill. It is to be noted that 460 of the 470 individuals on the island are salt plants, and that one of the pioneers, *Baccharis,* has already been lost.

The general features of dissemination by which these species may have reached this island across the intervening expanse of water has already been discussed in full[8] and will not be described in detail here. *Baccharis, Erigeron, Lactuca,* and *Pluchea* have plumed seeds which are readily transported over intervals of a few miles by gales or gusts of wind. The seeds of *Atriplex* float, and, as germination may ensue in the water and as the plantlets may float about for some time and then take root upon stranding,

[8] *Carnegie Inst. Publ. No. 193,* p. 125 ff. and 168 ff.

it is evident that a strip of water a mile or two in width instead of being a barrier might even facilitate the travels of this plant. The seedlings of *Sesuvium* and *Spirostachys* may also float about for some time and take root when cast ashore, and *Rumex* might be carried about in the lake in the same manner. Very small seeds such as those of the *Heliotropium*, *Spirostachys,* and *Sesuvium* may be picked up and carried long distances by the winds.

The reoccupation of this island has been studied with perhaps greater care than that of any other area which has ever come under the observation of a naturalist. The dissemination of plants by the flotation of seedlings seems to be a hitherto undescribed mode of travel by plants. Although the most serious efforts were made to detect the transportation of seeds by birds after the manner upon which so much has been written by Darwin and others, no well-proved case was found. The inference was strongly to the effect that the burrlike fruits of *Cryptanthe* had been carried to Cormorant Island and also to other beaches by birds.

The great trough in which the Salton Sea lies has been partially filled by alluvium carried into it by the Colorado River, which has finally built a great dam separating the trough from the Gulf of California. Every inflow has carried its contribution of sand and silt, the greater portion of which would naturally be deposited in the southernmost part of the trough, with the result that the surface has been raised to form a dam separating a part of the trough from the Gulf of California as the present basin. The present filling of the lake was exceptionally effective in this way. The silt-laden waters of the Colorado which flowed into the basin in 1904-07 through the streamways designated as New River and Alamo River cut deep and wide channels in the alluvium and carried down below the recent water levels a mass of material amounting to about twice the total taken out in excavating the Panama Canal, or one-fourteenth of a cubic mile (Figs. 6 and 7). The silt-laden water of the Colorado River deposits about 6 per cent of its volume as dried soil, so that the total fill left by the present flood is estimated as amounting to about one-third of a cubic mile. Otherwise stated, the present Salton Sea will leave below its high level one-twelfth of its volume in soil. This material is of course unevenly distributed, and every inundation of the basin results in filling and altered surfaces. The change in contour is especially noticeable at the present time and is readily observable since the lake in 1916 stood nearly at the same level as in January, 1906. The low inclines into which arms of the lake extended a decade ago are now filled, and the channels of the two inflowing streams now follow into the receding lake on lines widely variant from those used in the formation of the lake (Fig. 1). It is obvious that all of the alluvial fill in the basin might be accounted for by the floods of the last few hundred years and that all of the main events in its history might have occurred within comparatively recent time.

Salton Sea reached an area of about 450 square miles in 1907. It has now shrunken by uneven and halting recessions to a depth of hardly more than 30 feet, or less than half the maximum, with an area of less than 300 square miles. The overflow and wastage of the vast irrigated district in the "Imperial Valley," as the southern end of the basin is designated, is such that at certain times subsidence ceases and an actual rise occurs, although each June has found the level a yard or more below that of the previous year. Conditions now prevalent, however, will soon bring the lake down to an area of about 200 square miles, where its evaporation losses and fillings will give it the character of an oscillating lake. Thus the ancient Blake Sea, followed by the ephemeral or intermittent Salton Sea, has now been succeeded by a lake the permanency of which will be coincident with our present system of agricultural practice.

OUR TRADE IN THE GREAT WAR*

By MARK JEFFERSON

The war has brought a great expansion of foreign trade to the United States, the total for the year 1916 being nearly double the average amount for the years 1911 to 1914. In millions of dollars, the amounts were as follows:

1911	*1912*	*1913*	*1914*	*1915*	*1916*
3624	4217	4277	3903	5334 (5067)	7873 (5668)

The greater part of the increase of the last two years has been in exports:

Exports	2092	2399	2484	2114	3555 (3377)	5481 (3946)
Imports	1532	1818	1793	1789	1779 (1690)	2392 (1722)

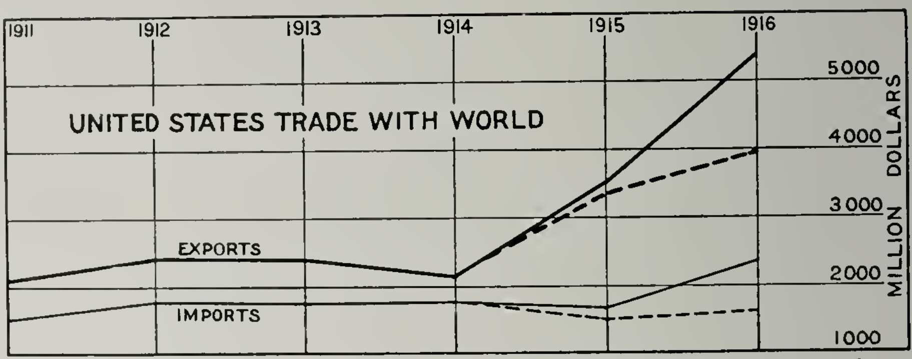

FIG. 1—Diagram showing the effect of the war on United States foreign trade. (The dotted parts of the curves in Figs. 1 and 2 indicate the values as corrected to eliminate the war inflation of prices; see the text.

And of the exports those to Europe have been most augmented:

Exports to Europe....	1293	1467	1500	1339	2573 (2444)	3814 (2746)
Other	799	932	984	775	982 (933)	1667 (1200)

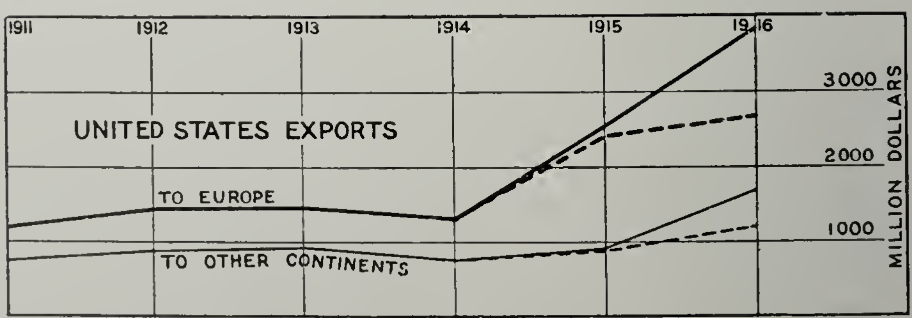

FIG. 2—Diagram showing the effect of the war on United States exports to Europe as compared with exports to other parts of the world.

But the prices of the years 1915 and 1916 have been unprecedentedly high. A part of the increase of business is therefore fictitious, being not an increase of goods but of money collected for them. From an examination

* The statements and terminology of this article apply to conditions prior to the entry of the United States into the war.—EDIT. NOTE.

of the exports to Europe, it appears that about one-half of the total for 1916 is made up of cotton, gunpowder, mineral oils, flour, brass bars and plates, horses, wheat, oats, corn, lard, hams and shoulders, bacon, and mules. These amounted to 1,773 million dollars of the total export to Europe of 3,814. Had they been reckoned at 1914 prices they would have been worth but 1,282 million dollars, or 72 per cent as much. Similarly the total exports to Europe in 1915 would have been worth 95 per cent as much at 1914 prices as at the prices actually charged. As a rough corrective to the effect of inflated prices in 1915 all figures for 1915 have been multiplied by 95 per cent and all those for 1916 by 72 per cent, with the result:

	1915	*1916*
Total foreign commerce of the United States	5067	5668

These and the other corrected values are indicated in parentheses in the tables above and as dotted lines in the diagrams. These new values and curves show that the inflation of prices contributed a good deal to the recent increase of trade, but it still remains true that there has been an unprecedented increase in our commerce, especially in our exports to Europe.

Of course it is obvious that this ought to be the case, for the great war is the only possible cause. It is striking that all the values fell sharply in 1914 and all the exports rose still more sharply in 1915 and again, but less strongly, in 1916. The retirement of German carriers from the oceans probably suffices quite of itself to explain the checked commerce in 1914. The decrease doubtless belongs to the last five months alone, but the financial disturbance at the outbreak of the war and doubts about payments and credits on shipments must also have had their influence.

It is of interest to examine our exports, both to Europe and to other continents. In the first place, without examining destination of goods it is significant that explosives and chemicals increased enormously, as the following (uncorrected) values show:

1911	*1912*	*1913*	*1914*	*1915*	*1916*	
14	14	15	22	245	844	million dollars

Metals, machines, and automobiles also—

371	454	481	367	715	1594	" "

Foods again were immediately called for:

		193	192	422	510	" "

There was immense increase in horses and mules:

		5	9	119	91	" "

and also in rubber—

13	14	14	12	24	34	" "

Plainly, our increased business was the exportation of war supplies to Europe. Note that explosives and horses and mules did not fall off in 1914, as did other materials, but contented themselves with very moderate increases. The urgency of the occasion diverted tonnage to these imme-

diate needs at once. Of course the supplies in most immediate demand went up strongly in price. Gunpowder was 33 cents a pound in 1914 and 83 cents in 1916. Much more powder must have been used in Europe these three years than in all the rest of the world. This consideration of the relation of the European demand to the world-demand must enter into the rise of prices, for they are affected very differently. Thus of oats were supplied 19 million dollars' worth in 1914, 59 million in 1915, and 53 million in 1916, at 54 cents, 56 cents, and 52 cents a bushel, oats being thus actually 4 per cent cheaper in 1916 than two years before!

The main items included above as "food" are corn, oatmeal, oats, rice, meats and dairy products, sugar, and potatoes. They are the food substances that have been exported in greatly increased quantities: corn and oats, amounting together to 28, 31, 97, and 100 million dollars in 1913, 1914, 1915, 1916; meats, amounting to 157, 137, 259, and 279 millions; butter and cheese, to 1.2, 1.5, 14, and 18 millions; condensed milk, to 1.4, 2, 6, and 18 millions; refined sugar, to 1.9, 18, 43, and 91. The sugar went presumably to England, which was taking 55 million dollars' worth of German sugar as far back as 1913 and must now look elsewhere. The prices assigned this sugar are of interest:

1911	*1912*	*1913*	*1914*	*1915*	*1916*	
1.4	3.6	1.9	18	43	91	million dollars
32	79	52	390	963	1577	million pounds
4.4	4.5	3.6	4.6	4.5	5.7	cents per pound

From this the American housewife may learn that our refiners have had refined sugar to sell abroad in huge quantities at a uniform price from 1911 through 1915, except for a cheapening of a third (33 per cent) in 1913, and that there has been but one increase, that of 27 per cent in 1916. Potatoes were exported at 90, 88, 76, 82, 67, and 122 cents per bushel; butter at 22, 26, 26, 24, 26, and 31 cents per pound. Some very important foodstuffs that were exported in greatly increased quantities did not rise very much in price. For instance, fresh beef was exported at the following prices in cents per pound: 10.7, 11.1, 11.8, 12.4, 12.8, and 12.2; bacon at 12.2, 12.2, 13.1, 13.9, 13.3, 14.7. But lard shows a greater rise: 9.9, 10.5, 11.3, 11.1, 10.7, 13.1. Wheat should have been included among the food substances exported in greatly increased amount, the millions of dollars' worth being 30, 60, 95, 187, 283, and 227, and the prices 110, 97, 95, 107, and 137, and 147 cents per bushel.

Cotton was as always a most important export, falling off greatly in the first two years of the war, but in 1916 coming up nearly to the earlier totals. The values and prices were:

1911	*1912*	*1913*	*1914*	*1915*	*1916*	
517	623	575	344	417	544	million dollars
60	58	67	55	50	78	dollars a bale

Doubtless the decrease in the amount exported in 1914 was caused by the cutting off of the markets of eastern and central Europe. Probably the

Allies used enough in making explosives to make up nearly the whole loss. But why should the price go up in 1916? Pig iron increased in quantity from less than two million dollars' worth in 1911 to nearly 16 million dollars' worth in 1916, and the price from $15.70 to $25.52. With these prices it is worth while to compare the importations of gold:

57 66.5 64 57 452 686 million dollars

To whom have these large exportations of goods from the United States gone? The better to answer this question let us classify the world into Allies, Central Powers, Near Neutrals, and Far Neutrals ("near" and "far" relating to distance from Germany). In detail the Allies are Canada, the United Kingdom, France, Portugal, Italy, Russia, and Japan. The Central Powers for commercial purposes are Germany, Austria-Hungary, and Turkey; the Near Neutrals, Netherlands, Denmark, Norway, Sweden, and Switzerland; and the Far Neutrals, Spain, Cuba, Argentina, and Brazil. The countries omitted are those that have very little commerce. A table is given later with all details, but here the totals (in millions of dollars) may be studied:

		1908	1909	1910	1911	1912	1913	1914	1915	1916
Central Powers	U. S. Exports to	275	266	276	320	357	377	174	12.2	2.2
	U. S. Imports from	152	193	200	202	224	225	183	55	6.6
Allies	U. S. Exports to	933	934	1010	1098	1299	1320	1254	2539	4251
	U. S. Imports from	452	606	640	615	742	737	736	681	908
Near Neutrals	U. S. Exports to	132	118	112	139	145	165	195	354	298
	U. S. Imports from	50	70	74	77	81	84	86	69	94
Far Neutrals	U. S. Exports to	114	121	149	165	188	199	146	229	353
	U. S. Imports from	185	267	284	258	327	276	320	432	526

These figures show that:

(1) Exports to the Central Powers were less than half their usual amount in 1914 and almost nothing in 1915 and 1916. We should expect the 1914 figures to show rather more than half a year's business, as the war did not break out till the beginning of the eighth month of the year. The practical disappearance of exports to the Central Powers resulted of course from the immediate disappearance of the German (and the Austrian) merchant fleet from the seas.

(2) About the same thing happened to the imports to the United States from the Central Powers. But it should be noted that the imports from these countries to us between 1908 and 1913 amounted to about two-thirds of our exports to them. It is usual for all European countries except Russia and Rumania to import considerably more value of goods than they export, as the rest of the world owes them interest on investments, freights, remittances of their emigrants, and payment of tourist expenses, all of which enter into the excess of goods sent to Europe from the ends of the earth. Now in 1914 the importations to the United States from the Central Powers were rather more than half the usual amount, and in 1915 and 1916, although enormously diminished, the amounts were three or four

times greater than the amounts received from us, the usual relation being thus reversed. The British blockade appears to have been more effective in keeping our goods from reaching Germany than in keeping theirs from reaching us; and very likely the principal effort of Great Britain was exerted in that direction.

(3) American exports to the Allied Powers increased strongly from 1909 to 1913. In 1914 they fell below the figures for 1912 and 1913, but were much greater than in earlier years. In 1915 the amount doubled and went a long way toward doubling again in 1916. Thus was the call of the Allies for help met by the United States. If we had figures for Argentina at hand they would probably show something of the same sort, as far as her resources go.

(4) Our imports from the Allies are usually rather more than half the exportations, and increasing. In 1914 they showed a slight diminution and a greater one in 1915, and, though they increased strongly in 1916, they were not a fourth as great as the exportations and were only larger because of the inflation of prices, as has been shown. We sent the Allies great increases of goods in 1915 and 1916 but did not receive more than usual from them. They paid us with gold and returned American securities.

(5) To both Allies and Central Powers we sent less in 1914 than in 1913. To the ring of Near Neutrals, however, that surround Germany and Austria, our exports were a fifth greater in 1914 than in 1913, almost double as much in 1915 as in 1914, and again largely increased in 1916; enough to show that despite the higher prices there was an actual increase of goods sent to these countries. It was these facts that satisfied the Allies that American goods were reaching the Central Powers by way of the Near Neutrals. The failure to drop in 1914 was the most suspicious feature of these sums, seen also in the detail for Denmark, Norway, and Sweden. The following curves of exports bring out the difference:

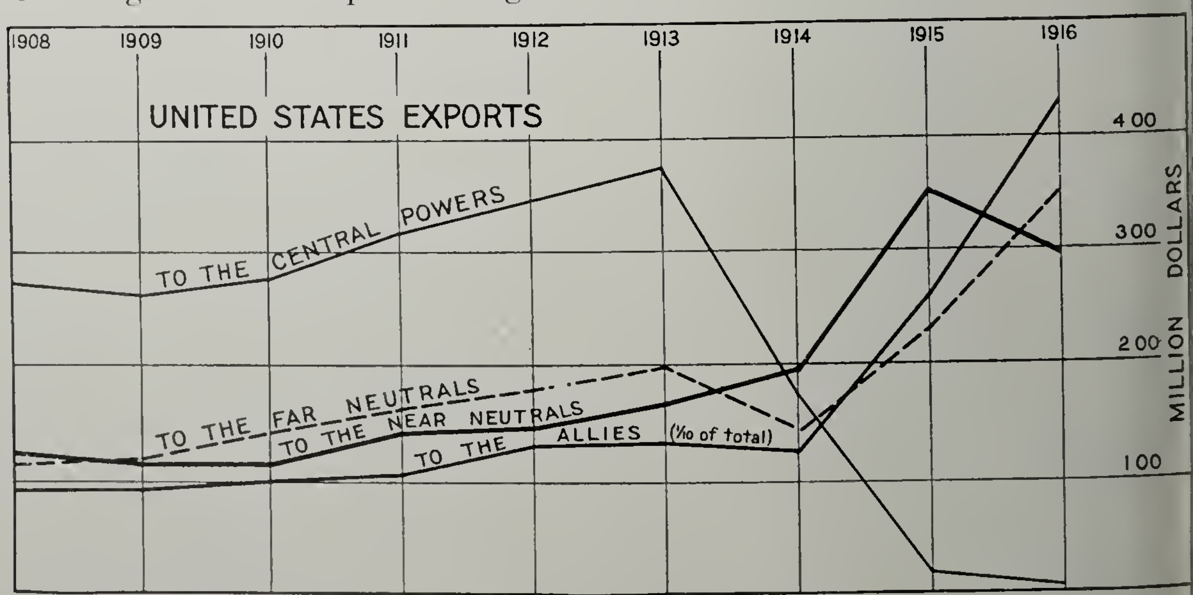

FIG. 3—Diagram showing the effect of the war on United States trade with the various groups of belligerents and neutrals. (To bring the curve within the range of comparison the exports to the Allies have been divided by 10.)

TRADE OF THE UNITED STATES WITH THE VARIOUS GROUPS OF BELLIGERENTS AND NEUTRALS AS AFFECTED BY THE WAR

(Figures denote millions of dollars)

	1908	*1909*	*1910*	*1911*	*1912*	*1913*	*1914*	*1915*	*1916*
With the Central Powers									
U. S. Exports to									
Austria-Hungary	15	16	16	21	24	22	13	0.1	0.06
Germany	258	247	258	295	330	352	158	12.0	2.0
Turkey	2	3	2	4	3	3	3	0.1	0.1
	275	266	276	320	357	377	174	12.2	2.16
U. S. Imports from									
Austria-Hungary	14	17	18	16	18	19	16	5	0.3
Germany	128	162	167	166	186	184	149	45	6.0
Turkey	10	14	15	20	20	22	18	5	0.3
	152	193	200	202	224	225	183	55	6.6
With the Allies									
U. S. Exports to									
France	117	126	115	128	155	153	171	501	861
Italy	61	57	53	61	74	79	98	270	303
Portugal	4	3	3	3	3	5	4	9	16
Russia	20	16	19	25	27	27	28	170	468
United Kingdom	554	521	551	539	607	591	600	1198	1888
Canada	153	188	242	299	375	403	311	345	606
Japan	24	23	27	43	58	62	42	46	109
	933	934	1010	1098	1299	1320	1254	2539	4251
U. S. Imports from									
France	89	132	122	122	134	139	104	78	109
Italy	43	50	49	46	52	55	55	51	60
Portugal	5	6	7	6	7	6	6	5	7
Russia	8	16	14	19	28	24	14	3	8
United Kingdom	172	247	271	250	313	272	287	258	305
Canada	71	87	103	94	121	142	164	178	237
Japan	64	68	74	78	87	99	106	108	182
	452	606	640	615	742	737	736	681	908
With the Neutrals Near Germany									
U. S. Exports to									
Denmark	19	15	13	15	16	19	42	74	56
Netherlands	98	89	85	106	110	122	101	143	114
Norway	6	6	6	8	8	9	20	46	66
Sweden	8	7	7	9	10	14	31	85	48
Switzerland	.7	.8	.8	.7	.8	.8	.8	6	14
	132	118	112	139	145	165	195	354	298
U. S. Imports from									
Denmark	1	2	2	2	3	2	4	3	3
Netherlands	20	31	31	34	37	38	37	28	44
Norway	4	6	7	8	8	8	12	7	6
Sweden	4	5	8	8	10	12	12	11	19
Switzerland	21	26	26	25	23	24	21	20	22
	50	70	74	77	81	84	86	69	94
With the Neutrals Far from Germany									
U. S. Exports to									
Spain	21	17	23	24	32	31	28	46	63
Cuba	42	48	58	62	65	73	68	96	165
Argentina	34	36	43	50	51	55	27	53	77
Brazil	17	20	25	29	40	40	23	34	48
	114	121	149	165	188	199	146	229	353
U. S. Imports from									
Spain	12	16	20	21	22	24	22	19	33
Cuba	79	107	128	106	138	125	147	198	244
Argentina	13	27	32	28	34	26	56	95	116
Brazil	81	117	104	103	133	101	95	120	133
	185	267	284	258	327	276	320	432	526
U. S. Trade with									
Near Neutrals	182	188	186	216	226	249	281	423	392
Far Neutrals	299	388	433	423	515	475	466	661	879

The values exported to the Allies are so large that it has been necessary to divide them all by ten to represent them on the same diagram with the other three groups. The Near Neutrals received a considerable increase of goods in the very first year of the war, in spite of the diminution of shipping. This the heavy line shows. Yet the Allies, with complete control of the seas, had their receipts diminished by a fourth. The same heavy line makes it clear that the receipts of Germany through these neutrals have since been much lessened.

(6) Imports of the United States from the Near Neutrals were in the neighborhood of a tenth as large as those of the Allies. Considering the inflated prices of 1915 and 1916, they imply that fewer goods were sent to the United States during the war than formerly. Undoubtedly the Near Neutrals found in Germany a better market for much of their merchandise.

(7) The Far Neutrals are peculiar in their commercial relations with the United States in that our imports from them are greater than our exports to them. This is not true, as the detailed table shows, of Argentina or Spain. To these two countries, as to most countries in Europe, our exports are greater than our imports. But business with Cuba and Brazil is large enough to offset the effect of this. Our exports to the Far Neutrals increased steadily till 1914, when they fell off strongly; but they picked up again with unusual vigor in 1915 and 1916. Considerably more goods were sent to them than before the war.

(8) But the striking thing with these countries is the much greater increase of the imports to the United States from them. Of Spain alone this is not true. Our business with Spain is of moderate amount and grows very slowly and does not appear to be influenced so much by the war as by prices.

In general, American business away from the seat of war is doing very well. We have a hugely increased export business with the Allies, though our business with the Central Powers is almost extinct.

Still, moderate amounts of our goods reach the Central Powers through their neighbors. We have lost some 350 million dollars' worth of direct exports to them against a gain through their neighbors of about 100 millions. As for the Central Powers, they are deprived of much-needed supplies in addition to the loss of markets for what stocks of manufactures they may have in hand that they cannot use. When the war closes Germany will want large shipments of American goods and will wish to send us German goods to pay for them.

THE VOLCANIC ACTIVITY OF MOUNT ST. HELENS AND MOUNT HOOD IN HISTORICAL TIME

By WILLARD ROUSE JILLSON

Not a little has been written in one form or another concerning the prehistoric and recent activity of those splendid volcanic cones of the Cascade Mountains which stand like sentinels on guard at the gateway of the Columbia River. Mount St. Helens (9,750 feet) in Washington is about forty miles north of the Columbia, and Mount Hood (11,225 feet) in Oregon is about twenty miles south. By reason of their dominant size (Vancouver reported Mount Hood to be 25,000 feet high), their beauty, and their relative position, these mountains have been called the "Guardians of the Columbia." About their magnificent, perpetually snow-clad peaks is woven a wealth of legend and description, which antedates the arrival to this North Pacific coast of the first intrepid Spanish and English explorers.

Perhaps the most unreliable, though not the least picturesque, source of information concerning the activity of these old volcanoes is to be found in the tradition and tribal lore of the Puget Sound, Columbia River, and coastal Indians. These primitive peoples, after nearly a century of contact with civilization, still speak with mingled awe and reverence of the "Fire Mountain" (Mount St. Helens) and the "Mountain That Was God" (Mount Rainier). Captain J. C. Frémont in his exploration camp on the Columbia River on November 27, 1843, wrote in his diary[1] with respect to Mount Hood and Mount Jefferson, the next prominent volcano to the south, "The Indian superstition has peopled their lofty peaks with evil spirits, and they have never yet known the tread of a human foot." The original diary of Lewis and Clark,[2] who reached the mouth of the Columbia in December, 1805, also alludes to this characteristic superstition. It does not refer, however, to volcanic activity in either Mount St. Helens or Mount Hood. S. F. Emmons in a report on "The Volcanoes of the Pacific Coast of the United States" says[3]:

> Even our half-civilized Indians of the Northwest, in spite of their association with the white man, cannot be induced, by hope of reward or fear of punishment, to approach the snow-covered peaks in their midst, whose actual manifestations of volcanic energy must exist in their minds as dim traditions.

The first authoritative reports of volcanic activity of these Columbia

[1] Report of the Exploring Expedition to the Rocky Mountains in the Year 1842, and to Oregon and North California in the years 1843-44, Office of Explorations and Surveys, War Department, Washington, 1845; reference on p. 199.

[2] Original Journal of the Lewis and Clark Expedition, 1804-1806, edit. by R. G. Thwaites, 7 vols. and atlas, New York, 1904-05; reference in Vol. 3.

[3] *Journ. Amer. Geogr. Soc.*, Vol. 9, 1877, pp. 45-65; reference on p. 45.

River volcanoes come from the same source. A little farther on[4] Emmons says:

Mt. St. Helens, on the other hand, is remarkable for its regular conical shape. It is . . . the only peak of which I was able to get a definite account of an eruption. I was told by an old French Canadian voyageur, formerly in the employ of the Hudson's Bay Fur Company, that St. Helens was in active eruption in the winter of 1841-2. To use his expression, the light from the burning volcano was so intense that one could see to pick up a pin in the grass at midnight near his cabin. . . .

Captain Frémont, again, writes[5] under the date of November 13, 1843:

Wherever we came in contact with the rocks of these mountains, we found them volcanic, which is probably the character of the range; and at this time, two of the great snowy cones, Mount Regnier [Mount Rainier] and St. Helens, were in action. On the 23d of the preceding November [Nov. 23, 1842], St. Helens had scattered its ashes, like a light fall of snow, over the Dalles of the Columbia, 50 miles distant. A specimen of these ashes was given to me by Mr. Brewer, one of the clergymen at the Dalles.

Evidence in corroboration of this statement and date is to be found in various sources, the most authoritative of which is the following. The Rev. J. L. Parrish of Salem, Oregon, writing in *Steel Points,* a Portland (Ore.) mountaineering quarterly magazine, says[6]:

. . . On the 22d day of November, 1842, I was in the old Mission house, ten miles below Salem, with several other missionaries. . . . I stepped outside and noticed the eruption of Mt. St. Helens. . . . We saw arising from its summit immense and beautiful scrolls . . . of steam. Then came a stratum just below . . . which was an indefinite gray. Then down next the mountain's top the substance emitted was black as ink. The next day . . . I noticed that she [Mount St. Helens] had changed her snowy dress of pure white for a sombre black mantle. The ashes fell at the Dalles to the depth of half an inch. . . . The eruption was on the south side of the mountain about two-thirds of the distance from the bottom to the top.

About sixty miles to the south of Mount St. Helens and just across the Columbia River stands the picturesque cone of Mount Hood, the "Pride of Portland." Geographically and geologically its history is linked with that of Mount St. Helens as well as a number of lesser associated peaks. Its volcanic activity may be traced (if signed reports published in Oregon and Washington newspapers and periodicals may be relied on) to a much more recent date than that of its sister mountain. W. F. Courtney of Walla Walla, Washington, writing of activity in Mount Hood in the *Everett* (Wash.) *Record,* May 17, 1902, says[7]:

The eruption took place during the latter part of September, 1859. . . . We were camped on Tie Ridge about thirty-five miles from Mount Hood. . . . It was about 1:30 o'clock in the morning . . . when suddenly the heavens lit up and from the dark there shot up a column of fire. With a flash that illuminated the whole mountainside with a pinkish glare, the flame danced from the crater. . . . For two hours, as we watched, the mountain continued to blaze at irregular intervals, and when morning came Mount

4 p. 53.
5 *Op. cit.*, pp. 193-194.
6 Vol. 1, No. 1, pp. 25-26.
7 Quoted in *Steel Points*, Vol. 1, No. 3, p. 135.

Hood presented a peculiar sight. His sides, where the day before there was snow, were blackened as if cinders and ashes had been thrown out.

Under the title of "Eruptions of Mount Hood" the weekly *Oregonian* (Portland) of August 20, 1859, says in part[8]:

On Thursday night the fire was plainly seen. . . . Yesterday the mountain was closely examined, when it was seen that a large mass of the northwest side had disappeared. . . . The dense cloud of steam and smoke constantly rising over and far above the summit, together with the entire change in its appearance heretofore, convinces us that Mount Hood is now in a state of eruption, which has broken out within a few days.

The most recent recorded activity of Mount Hood occurred September 21, 1865. The *Oregonian* of September 26, 1865, says in part[9]:

It is some time since we have had an excitement about Old Mount Hood belching forth, but on Saturday last the active puffs of dense black smoke were witnessed by hundreds of people in this city.

Farther on[9] it prints a letter from a John Dever, Company E, 1st Regiment Washington Territory Volunteers, written at the Vancouver, Wash., barracks, where he was a part of the guard in the early morning of June 21, 1865:

. . . Judge, then, of my surprise to see the top of Mount Hood enveloped in smoke and flame . . . accompanied by discharges of what appeared to be fragments of rock, cast up a considerable distance, which I could perceive fell immediately with a rumbling noise not unlike distant thunder. This phenomenon was witnessed by other members of the guard. . . .

The probability of the genuineness of these and similar statements will not be questioned by any one who is familiar with the geology and the physiography of Mount St. Helens and Mount Hood. Each of these mountains is a beautifully symmetrical cone the higher elevations of which are only slightly scarred by stream and glacial erosion. Mount Hood is the more sharply pointed, owing to the loss of a part of the crater rim. Both mountains show toward their bases well-developed lateral drains choked with lava flows, minor vents, and "blow holes." In many cases these flows present a most strikingly recent appearance, with bright, new, and strongly outlined surfaces, neither aggraded nor degraded, and barren of any vegetation except the scantiest.

Various travelers, prospectors, and United States army officers who penetrated into the primeval forests of this northwest wonderland have noted these things, and each one has brought back his own story. Lieut. C. P. Elliott, U. S. A., after exploring Mount St. Helens, made a rough reconnaissance topographic map of the area.[10] He noted the choking and damming of the lateral drains and speaks in particular of two instances which have a present bearing. The first one is that of a drain into the Kalama River, where the lava dam has formed the beautiful Lake Merrill ("Trout

[8] Quoted in *Steel Points*, Vol. 1, No. 3, p. 136.
[9] Quoted in *Steel Points*, Vol. 1, No. 1, p. 23.
[10] Mount St. Helens, with map, 1:180,000, *Natl. Geogr. Mag.*, Vol. 8, 1897, pp. 226-230.

Lake," by some), which is unique in that it has no surface outlet and appears never to have had one. Speaking of this lava dam he says: "Further to the north and toward the Kalama River, where the lava flowed over the standing trees (the places of the trunks now forming wells in the lava), running water can be heard." Russell, in his "Volcanoes of North America,"[11] notes that Mount St. Helens, which was ascended as early as 1889, "seems to have been active in recent years, and is fresher in appearance than Mount Hood." He also refers to the lava-damming of Lake Merrill, the lava tree casts, the still active "fumaroles," and the recent "blow holes" on the long lava flow on the southwest side of the mountain. Lieutenant Elliott has referred[12] to this lava bed, which finds its origin somewhere near Butte Camp at an elevation of 4,500 feet, and flows and cascades down a number of old valleys for nearly ten miles to the Lewis River, where it terminates in a number of large conical "blow holes" at an elevation of 1,000 feet. Its principal course lies between Cougar Creek and Big Creek, mainly in two large drains, one of which supplies the underground water for Lost Creek. Incidentally this superb lava flow is chiefly notable throughout the Northwest for its great cave, over a mile in length and one of the largest of its kind in North America.[13] This flow has been identified as the one referred to by Frémont, Parrish, and Emmons as being active on November 22, 1842, and also possibly in 1841.

The summer of 1915 was spent by the writer in studying in the field the geology and physiography of Mount St. Helens and its environs. On August 5, 1915, the summit was reached after a hard two hours' climb from Butte Camp. Previous to this, three weeks had been spent at an elevation of 4,000 to 7,000 feet, where many evidences were found of recent mild eruptions. Among other things of interest disintegrating charcoal and wood fiber in one of the horizontal lava tree casts in the great flow of the southwest side of the mountain were discovered. This evidence is made the subject-matter of another paper, "New Evidence of a Recent Volcanic Eruption on Mount St. Helens, Washington."[14] The importance of this discovery was anticipated by J. S. Diller, who speaks[15] at length as to the value of these lava tree casts. His deductions, made from a résumé of the better known literature, are that mild eruptions of diminishing strength and duration have most likely occurred on Mount St. Helens within the last century.

In conclusion it seems worth while to call attention summarily to the following facts. The separate and unrelated reports and statements of Frémont, Emmons, and Parrish fix without question the date of November 22, 1842, as one of considerable volcanic activity of an eruptive and extru-

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[11] New York, 1897, p. 241.
[12] *Ibid.*, p. 228.
[13] The Lava Caves of St. Helens, *Mazama*, Vol. 2, 1900-05, pp. 134-135.
[14] *Amer. Journ. of Science*, in press.
[15] Latest Volcanic Eruptions of the Pacific Coast, *Science*, Vol. 9, 1899, pp. 639-640.

sive nature on Mount St. Helens. The reports of Diller, Elliott, and others establish without doubt the recency of such volcanic activity. In consideration of the charcoal and wood fiber in the lava casts it may be that the last ebbing tide of extrusive vulcanism of Mount St. Helens continued on in a feeble, localized, and intermittent way until well into the third quarter of the nineteenth century, as published observations have shown to have been the case with Mount Hood. In the light of this suggestion it is interesting now to reconsider causally what vital rôle may have been played in the lives of the early natives of this part of the Cascade Mountains at no really distant date by these two "Guardians of the Columbia."

GEOGRAPHICAL RECORD

NORTH AMERICA

The Aërial Defense of the Coasts of the United States. To the two traditional branches of our national defense service it is now proposed to add a third. It is argued by Rear Admiral Robert E. Peary, and the present war has fully demonstrated the strength of his contention, that the command of the land and the sea is more than worthless, it is impossible, without the command of the air. The Sheppard-Hulbert Bill, before Congress, would provide a Department of Aëronautics, and through this it is proposed to develop a comprehensive aëro coast-defense system of patrol. The system would comprise a continuous cordon of sentinel planes a hundred miles or more off the coast and large aëro-squadron stations near all the principal coastal cities, to protect the cities from air raids and to carry out offensive operations against hostile fleets and their attendant air squadrons. The air scouts would also convoy merchant and troop ships, serve as the eyes of mine layers, search out submarine bases in highly indented coasts, locate submerged mines, and assist ordinary craft in naval engagements. At least two thousand sea planes are required for each coast. The *Emden*, the *Moewe*, the *Appam*, and other raiders have demonstrated that it is easy for enemy craft, under cover of night or thick weather, to creep close inshore unperceived. A single one of these steamers could bear fifty warplanes. In addition, each of the larger enemy submarines could carry planes, equipment, and ammunition. In the face of these real dangers, and in line with the development of air service abroad, the tactical study of air control and the meteorological factors involved is one of the major defense problems of the day. (For details see the following articles by Rear Admiral Peary: Command of the Air, *Senate Document No. 687, 64th Congress, 2nd Session*, Washington, 1917; Air Power for the United States, *Saturday Evening Post*, May 12, 1917, pp. 10 *et al.*; also a report of the Advisory Committee on Aëronautics by Murray Hulbert in the House of Representatives, April 13, 1917, printed in the *Congressional Record*.)

Food Production on Reclaimed Land in the West. Secretary Lane of the Department of the Interior has issued an appeal and a warning to the owners of unused but reclaimed land in the West. There are 700,000 acres of land on government projects for which reservoirs have been built, water accumulated, and ditches dug, but which have not been put under cultivation. It is estimated that this land would produce fifteen million dollars' worth of food each year, or an amount capable of feeding twenty thousand families and also an entire army division at the front. The lands now belong to private owners, but Secretary Lane warns them that no one is at present entitled to that which he does not use and that if the property is not made food-producing the time may not be distant when confiscation and government cultivation may be necessary (*Official Bulletin* [the new government organ, published daily by the Committee on Public Information, which is "designed to inform the public on the progress of the war and of official acts incident to its prosecution"], May 10, 1917, Vol. 1, No. 1, p. 3.)

The Opening of the Hell Gate Bridge in New York City. On April 1 the Pennsylvania Railroad Company opened the Hell Gate Bridge. With its single span of 1,000 feet this is the greatest arch bridge in the world. It has, however, an interest beyond that of a great engineering achievement: it is a work of national importance. Its completion permits an all-rail route along the entire Atlantic coast of the United States from Key West to the Canadian border and beyond to St. John, Halifax, and Sydney, Cape Breton. Heretofore transportation along this route has been broken by the water barriers that surround New York City. The stages by which they have been overcome—the train-ferry carrying the "Federal Express," the Hudson and East River tunnels—are indicated by Ellsworth Huntington in his article "The Water Barriers of New York City" (*Geogr. Rev.*, September, 1916). The map accompanying the article shows the location of the bridge: it unites the mainland in the southern part of Bronx Borough with the northern shore of Long Island via Ward's and Randall's Islands and thus provides connection with the main line of the Pennsylvania Railroad. Today the strategic consequences of the opening of the bridge are perhaps the most arresting, yet the facilitation of commercial movement should not be overlooked. By the connecting railways on Long Island and the short car-ferry between Bay Ridge at the extreme west of the island and Greenville Pier on the New Jersey shore freight will be saved the long passage through the East River (S. A. Bonnaffon: Hell Gate Bridge, *Commercial America*, April, 1917).

An Archeological Expedition to One of the Zuñi Pueblos. Our knowledge of the geography of Arizona and New Mexico had its beginning in the report of the journey

of Fray Marcos de Niza in 1539 and in the various chronicles of the famous expedition of Francisco Vasquez de Coronado in the year following. Fray Marcos drew his remarkable outward journey to a close when he viewed from a height in western New Mexico a large pueblo of the Zuñi Indians, that one of the "Seven Cities of Cibola" known as Hawikuh. In 1540 Coronado's advance guard stormed and captured the village, in which action the leader almost lost his life. At this period Hawikuh, or Granada as Coronado named it, consisted of 200 houses, or probably 800 to 1,000 inhabitants. In 1629 the pueblo became the Franciscan mission of La Concepción, and in 1670 it was raided by the Apache or the Navaho, the priest killed, and the pueblo abandoned, although it may possibly have been occupied from time to time during the next ten years, but certainly not after the great Pueblo revolt of 1680.

After this lapse of 237 years, Hawikuh is about to take on new life, so to speak, for a joint expedition has been organized by the Museum of the American Indian, Heye Foundation, of New York, and the Bureau of American Ethnology of the Smithsonian Institution at Washington, for the purpose of completely excavating the ruins of this extensive settlement. The work will be conducted under the personal supervision of Mr. F. W. Hodge, Ethnologist-in-Charge of the Bureau of American Ethnology, assisted by Mr. Alanson Skinner of the Museum of the American Indian. By reason of the fact that Hawikuh was inhabited from prehistoric times until 130 years within the historic period, its ruins afford an excellent opportunity for a study of the effect of contact on the Indians by the early Spanish explorers and missionaries, as well as of the culture status of the Zuñi people at the time they first became known. The expedition has been made possible largely by the patronage of Mr. Harmon W. Hendricks, a trustee of the Museum of the American Indian, who has generously offered to bear the field expenses during the season of 1917.

SOUTH AMERICA

The Impending Rapprochement of Chile and Peru. The early renewal of diplomatic relations between Chile and Peru, recently forecast in the press (*New York Times,* April 20, 1917), recalls what is doubtless the most interesting problem in political geography in all South America. The rich and disputed nitrate territory of northern Chile, forcibly seized by that nation in the war with Peru in 1879-83, was never returned to its owner. A promised plebiscite was never held. Each nation has accused the other of "planting" colonists in the disputed territory against the day when a deciding vote should be taken. First one nation and then the other has concentrated troops in the direction of the frontier for years. Among minor troubles may be mentioned a single episode in 1911. Dock laborers at Mollendo refused to unload Chilean vessels for several days, with the result that cargoes destined for Bolivia were carried to Valparaiso and back again, at the consignee's expense. Riots at Arica and Iquique in the same year were followed by the return of Peruvian settlers. In spite of the threat of war, fat revenues have accrued to the Chilean treasury.

Bitterness between the two neighboring countries has been marked by the resignation of one Peruvian ambassador after another as each failed to secure the return of the "unredeemed" national lands. So tho Tarapacá-Tacna region has been called the Alsace-Lorraine of South America. But both nations are small and relatively weak, and in later years, with Peru and Colombia in serious and, at one time, in armed dispute over the Putumayo rubber country, the nitrate region resembled rather the Balkan hotbed than Alsace-Lorraine. Thanks to the present war the principle of sympathetic co-operation between small states has gained immeasurably in popular esteem. The South American republics have sought friendly counsel of each other. If peace and cordiality should become a mutual and living force in Peru and Chile the hardships which the war has brought their peoples will seem a small price to pay.

Return of Dr. Hamilton Rice's Expedition from the Amazon. Dr. Hamilton Rice, a Councilor of this Society, returned to New York on April 24 from his expedition to the Amazon on the steam yacht *Alberta,* which he had chartered for that occasion (see the December, 1916, *Geogr. Rev.*, p. 467; to the list of members of the staff there given add Dr. Robert A. Lambert, pathologist at the Presbyterian Hospital, New York City; John W. Swanson, wireless expert; John C. Couzens, engineer and in charge of launch).

The Amazon River was ascended to Iquitos in Peru, a distance of 2,100 miles from its mouth, and the upper portion of the river from Manáos to Iquitos, known as the Solimões, was charted and a tracing made of the channel the yacht followed. The navigable course varies greatly from year to year, and it was thought that a series of charts, if taken over a consecutive number of years, would show the tremendous

activity of the river, due to its immense volume, its rapid current, the quantity of detritus it carries, and the quality of the land through which it flows. It is here that lateral erosion and fluvial activity in general can be studied on a stupendous scale.

The *Alberta* is the first yacht to ascend to Iquitos. In 1898 the U. S. gunboat *Wilmington* and in 1909 the British gunboat *Pelorus* went up the river to this point. It was also about 1898 that Commodore Benedict in the *Oneida* ascended as far as Manáos. Ceroncio Mello, an expert who knows the river from Pará to Iquitos, piloted the *Alberta*. He was also pilot of the *Pelorus* on her voyage in 1909. Some idea of the skill and remarkable qualities of the Amazon pilots may be had from the fact that they have no charts but are dependent solely on memory and an extraordinary ability in judging the ever-changing main navigable channel from the condition of the banks and the movements of the currents.

On the return to Manáos from Iquitos the river boat *Inca* was chartered and the Rio Negro ascended to Santa Isabel, 425 miles above Manáos. Lashed to the *Inca* were the launch *Eleanor*, a staunch craft especially constructed for the work by the Seabury Company of New York, and a steel *varenga*, or lighter, employed for extra supplies, fuel, etc. From Santa Isabel to the mouth of the Caiary, or Uaupés, the largest right tributary of the Negro (explored by Dr. Rice in 1907-08), the river bed is filled with rocks, and several *cachoeiras*, or bad rapids, occur, those between Camanáos and São Joaquim forming a stretch of over 30 miles of broken water, foaming rapids, whirlpools, and cross currents. It was impossible to take the lighter beyond Camanáos, but the launch passed up to São Gabriel without accident and fell back again to get supplies from the cache at Camanáos. On the second ascent in one of the first stretches of bad water the launch sustained several bad knocks and a hole was punched amidships on the starboard side, but she managed to reach São Gabriel. Here temporary repairs were made and she was taken down river to Umarituba, where more thorough work was possible. During this delay the river fell steadily, and on the launch's return from Santa Isabel it was impossible to ascend above Camanáos.

An attempt was then made to ascend the Padauiry, a left tributary of the Negro farther downstream, but a huge sandbank completely choked the mouth of the Prêto, into which the Padauiry discharges just above the former's confluence with the Negro, and this plan had also to be abandoned. Descent was then made along the north bank of the Negro back to Manáos. It was along this shore that Dr. Alfred Russel Wallace tried unsuccessfully to descend in 1851, and Spence refers to it as *terra incognita*.

The objects of the expedition were: (1) A topographical, hydrographical, and geological survey of the Rio Negro, the investigation of its analogies and differences in relation to the other big tributaries of the main river, and the construction of a detailed map. (2) To test the practicability of receiving signals from Radio, Virginia, with a portable field wireless set, thus simplying the usual method of determining the differences of meridian distances by employing Washington as the prime meridian with which to compare the field stations of secondary and tertiary meridians. (3) An inclusive investigation of the diseases of the river, their etiology, prevalence, and prevention.

AUSTRALASIA AND OCEANIA

A Unique Grassland in New Zealand. About one-seventh of the occupied surface of New Zealand is characterized by the plant formation known as montane tussock grassland. On the eastern slopes of the Dividing Range it stretches in an almost unbroken band from the Wairau River in the north of South Island to the heavily wooded mountains of Southland, occupying a zone between the agricultural lowlands to the subalpine highlands. Patches of southern beech forest in favored locations are the sole interruptions. This grassland appears to represent the ultimate formation in the natural vegetative cover. Moreover it apparently survives man's intervention in an extraordinary manner. Despite burnings, grazings, and other usually destructive operations it is today little different from what it was half a century ago. Its value, however, is comparatively low; whence arises the question of possible improvement. The carrying capacity, even where supplemented by summer grazing on the subalpine pastures, is not more than one sheep to three acres, and from the total area of six million acres the wool production averages two and a half pounds per acre per year, a return greatly inferior to that from any other of the occupied lands. The nature of the land tenure (short leasehold) and the great size of the individual runs are partly responsible for retarded developments, and as yet no experimental work has been done with a view to determining suitable species for introduction into this distinctly xerophytic grassland (A. H. Cockayne: Some Economic Considerations Concerning Montane Tussock Grassland, *Trans. and Proc. of the New Zealand Inst.*, New Issue, Vol. 48, Wellington, 1916).

Exploration in Southern Papua. The Society has received from one of its Life Fellows, Dr. Arthur Wade of Australia, a valuable though brief account of his latest detailed surveys in Papua, or British New Guinea. The communication is dated February 1, 1917. His expedition of 1916 met with new peoples from among the mysterious Kuku tribes, whose customs are extraordinary even for Papua. They inhabit the hill country at the headwaters of the Vailala River and have only recently been persuaded to venture below the rapids that occur at the Puve Hills above the deserted village of Me. In addition to a polished bone piercing the septum of the nose, they insert long vegetable fibers, which give their faces a catlike appearance. Their canoes are simple dugouts without outrigger and are decorated in blood or vegetable stain, with drawings of fish, birds, crocodiles, and their common food plants. Before the time of Dr. Wade's expedition this type of canoe was wholly unknown on the Vailala River, and indeed it is doubtful if it has yet been discovered anywhere else in Papua. The results of the surveys will be represented on topographic maps which will throw light on the structure and origin of hitherto unknown areas. Raised beaches, river terraces, and deserted river beds show that the region has been rising rapidly in recent times and that the movement still continues.

Dr. Wade's former expedition of 1913-14 to the coastal belt about Port Moresby was noteworthy in its results. Three thousand square miles of trackless jungle and sago swamp were surveyed and the coast line between the Purari delta and Yule Island accurately mapped for the first time. The maps, on the scale of 2 miles to the inch, are included in the "Report on Petroleum in Papua" *(Australian Parliamentary Paper, 1914-15, No. 61, F 5163)*. This report also contains important short sections entitled "Climate and Health" and "Native Labor."

The discoveries of Dr. Wade again illustrate the unknown character of much of the interior of New Guinea, the second largest island in the world, and enhance the interest in Dr. Eric Mjöberg's proposed aërial expedition, described in the February *Review* for this year.

Abnormal Rainfalls in Australia. From Mr. H. A. Hunt, Commonwealth Meteorologist of Australia, there have recently been received newspaper reports concerning some phenomenally heavy rainfalls in Victoria and New South Wales. About the middle of September, 1916, there began a great drift of warm, moisture-laden air, coming from the equatorial oceans north of Australia, southward over the eastern half of Australia. This movement extended much farther south than usual and was long-continued. Reaching high, and cooler, latitudes, the moisture in the warm air was condensed and fell as rain. For about two weeks a trough of low pressure extended from north to south across eastern Australia. This depression moved very slowly, and this fact accounted, at least in part, for the phenomenal rainfall. The distance traveled by the depression in a week was 500 miles, while the usual rate of progression is 400 miles a day. The total downpour was tremendous and established a "record" in many sections. The Commonwealth Meteorologist estimates (1 cubic foot of water = 62½ pounds) that over 400,000 square miles of Victoria and New South Wales the rainfall was nearly 4 inches. This represents a fall of roughly 100,000,000,000 tons of water; 250,000 tons to the square mile, or nearly 400 tons per acre. Enough water fell to fill the Assuan reservoir more than one hundred times.

Other depressions, coming also from the north, followed the remarkably rainy period of September and gave an altogether abnormally wet spring. While no positive statement can be made as to cause, it appears likely that the great southward movements of the air, which gave the heavy precipitation, resulted from an abnormal "sagging" to the southward of the thermal equator. In two and a half months, it is estimated that eastern Australia received 800,000,000,000 tons of water, nearly all drawn from tropical seas (1 inch of rainfall = 100 tons per acre, and 64,000 tons per square mile). This was equal to about 45,000,000 gallons per head of the population of the area over which the rain fell. The total fall was equal roughly to 180 billion gallons.

R. DeC. Ward.

HUMAN GEOGRAPHY

Climate and Human Evolution. In a recent paper Professor Joseph Barrell offers an interesting hypothesis as to the way in which man first came down from the trees to walk upon the solid earth (Probable Relation of Climatic Change to the Origin of the Tertiary Ape-Man, *Scientific Monthly*, January, 1917). It is now generally conceded that the great change from a four-handed, unintelligent, apelike, and arboreal creature to an intelligent manlike creature who walked on two feet and worked with two hands occurred in some part of Central Asia beyond the limits of the tropics. Pro-

fessor Barrell believes that the original man-ape would never have left the trees except under the strongest compulsion, for life on the ground is extremely dangerous for so poorly defended a creature. If the forest which formed the apes' home were to disappear, however, and he could not migrate to some other forest, he would be forced to the ground. In the Miocene period the uplifting of the Himalayas and other great ranges apparently raised an impassable barrier between northern and southern Asia. At the same time the climate of the regions north of the mountains became dry. Hence the forests gradually disappeared. Man could not follow them southward because of the mountains. Therefore, according to Professor Barrell, he was more and more compelled to betake himself to the ground. This subjected him to such extreme dangers that the cleverer, more quick-witted types—the ones that had the sense to use sticks and stones or to deceive their enemies—had a tremendous advantage. Hence mental development was at a great premium, and the human brain evolved with remarkable celerity.

A later, but nevertheless remote, phase of the effect of climate on man's evolution seems to be pictured in the ancient holy books of Persia. In a paper entitled "Iranian Migrations before History" (*Scientia,* Bologna, February, 1916) Mrs. Maunder recounts a tradition which was already hoary when put into fixed form about 2,500 years ago. The Venidad, or ancient Anti-Demoniac Law of Persia, describes sixteen good lands. The first and best of these, Airyana Vaego, was so full of "flocks and herds, men, dogs, and birds, and red blazing fires," that there was no room for more. At that time the hero Yima was warned of the approach of "fatal winters . . . that shall bring the fierce, foul frost, . . . that shall make snowflakes fall thick." Airyane Vaego became a place where "there were ten months of winter, two summer months," where "winter falls . . . with the worst of plagues." Where was this cold region? A student of Indian mythology might answer that it was in the Himalayas, for the ancient books of Kashmir preserve a similar tradition. Mrs. Maunder answers differently. She cites the tradition of a land in which the summer day is twice as long as the summer night. That would be about latitude 49° or higher. A still more northern location, however, is suggested in Venidad, for in the land whence Yima migrated "the stars, the moon, and the sun are only once [a year] seen to rise and set, and a year seems only a day." Such a description, Mrs. Maunder believes, could apply only to a region north of the Arctic Circle, where day and night each endure for months. Hence she concludes that at some time during their history the Iranians must have dwelt north of the Arctic Circle and that at that time the climate must have been much milder than at present. Later the advent of a glacial epoch or at least of a severe glacial stage—although these terms are not used—drove the people out of their inter-glacial homes.

Other parts of the old Iranian books relate how the people longed for rain through the spring and eagerly awaited the first heavy downpour about the time of the summer solstice. The reference is obviously to the monsoon rains of India. From the far north the Iranians were apparently driven to India, where they remained long enough so that their traditions became saturated with the idea of summer rains, a thing unknown in Iran. There seems good reason to accept Mrs. Maunder's idea that the traditions point to extensive migrations due to alternate epochs of stormy and of mild climate. A long residence of the primitive Iranians north of tho Arctic Circle may be questioned, but if their main home was in the Altai region, for example, small bodies of wandering hunters may often havo pressed so far north that they were familiar with the midnight sun.

Ellsworth Huntington.

GEOGRAPHICAL NEWS

A New Series of Topographical Bulletins. The National Highways Association has for some years been promoting the improvement of the main roads of the United States. To this end it enlisted tho assistance of a large body of experts, which were organized into various divisions. Professor W. M. Davis is chairman of the division of physical geography, which has begun the publication of a series of special bulletins. *Physiographic Bulletin No. 1,* dated May, 1917, has just appeared. In it Professor Davis has performed the useful service of emphasizing the need for a more rapid survey of our national domain, only forty per cent of which has been topographically surveyed. The work is important from many aspects, but chiefly from that of preparedness and of travel and economic development. This first bulletin contains striking reprints from sixteen sheets of tho topographical map of the United States already published by the U. S. Geological Survey. They are intended to show interesting portions of mountain and coast line and are accompanied by running comments greatly condensed in form. The bulletin closes with an appeal for the wider use of the maps of the U. S. Geological Survey and for their study by local organizations, as for example, the Boy Scouts.

Summer Session Courses in Geography

(Unless otherwise noted, the instructors belong to the faculty of the institution at which they are giving courses)

University of Alabama, University (June 5–July 18).
General Geography. Miss S. E. Luther of the Conecuh County High School, Castleberry, Ala.

Boston University, Boston, Mass. (July 2–August 11).
Economic History of the United States. Asst. Prof. C. P. Huse.

California State Normal School, Chico (June 4–?).
Geography. Mr. C. K. Studley.

University of California, Berkeley (June 25–August 4).
Physical Oceanography, Including Some Related Phenomena of Meteorology. Dr. G. F. McEwen of the Scripps Institution for Biological Research.
Economic Geography. Mr. P. S. Barnhart of the Scripps Institution for Biological Research.
The Teaching of Geography in Elementary Schools, With Special Reference to Regional Geography. Miss C. B. Kirchwey of Teachers College, Columbia University.
The Teaching of Geography in Secondary Schools. Miss C. B. Kirchwey.
Principles of Plant Ecology. Prof. Francis Ramaley of the University of Colorado.
Race. Asst. Prof. T. T. Waterman.

University of Chicago (June 18–July 25 and July 26–August 31).
Physiography. Asst. Prof. A. O. Thomas of the University of Iowa. Second term.
Geographic Geology. Prof. R. D. Salisbury, first term; Assoc. Prof. R. C. Moore, second term.
Continental Evolution. Prof. R. D. Salisbury, first term; Asst. Prof. A. O. Thomas, second term.
Meteorology. Assoc. Prof. W. S. Tower.
Distribution and Causes of Rainfall. Prof. Mark Jefferson of the Michigan State Normal College at Ypsilanti. Second term.
Physiographic Ecology. Prof. H. C. Cowles and Dr. G. D. Fuller. First term.
Ecological Plant Geography: Regional and World Problems. Prof. H. C. Cowles. Second term.
Economic and Commercial Geography. Asst. Prof. W. D. Jones.
Conservation of Natural Resources. Prof. H. H. Barrows.
Geographic Influences in the History of the Interior. Prof. H. H. Barrows.
Geography of South America. Assoc. Prof. W. S. Tower.
Northern Europe. Prof. Mark Jefferson. Second term.
Geography of Asia. Asst. Prof. W. D. Jones.
Geography in the Primary Grades: Home and World Geography. Assoc. Prof. Zonia Baber.
Geography in the Grammar Grades: North America. Assoc. Prof. Zonia Baber.
Geography in the Grammar Grades: South America. Assoc. Prof. Zonia Baber.
Geography in the High School. Assoc. Prof. Zonia Baber.
Field Course in Geography in Southeastern Minnesota. Mr. C. C. Colby.
Field Course in Geography in the Mississippi Valley between LaCrosse, Wis., and Minneapolis. Mr. C. C. Colby. July 27–August 23.
Field Course in Geography in the Lower St. Lawrence Valley and the Maritime Provinces. Assoc. Prof. W. S. Tower. Sept. 1–29.

Cleveland School of Education (conducted jointly by Western Reserve University and the Cleveland Normal School), Cleveland, Ohio (June 18–July 27).
Physical Geography. Prof. W. M. Gregory of the Cleveland Normal School and Miss Hungerford.
Industrial and Commercial Geography. Prof. W. M. Gregory and Miss Hungerford.
The Teaching of Geography. Prof. W. M. Gregory and Miss Hungerford.

University of Colorado, Boulder (June 25–August 4).
Principles of Earth Science. Prof. W. E. McCourt of Washington University, St. Louis.
Climatology. Mr. N. E. A. Hinds.
Geographic Influences. Prof. W. E. McCourt.
Industrial Geography. Prof. W. E. McCourt.
Geographic and Geologic Excursion to Interesting Places in Colorado, Utah, and Wyoming. Prof. W. E. McCourt. August 4–28.
Special Lectures: (1) The New Geography; (2) The Face of the Earth; (3) Earth Sculpture; (4) Grand Canyon of the Colorado; (5) Glaciers; (6) Rocky Mountain National Park; (7) Yellowstone National Park. Prof. W. E. McCourt.

Columbia University, New York City (July 9–August 17).
- Mathematical Geography. Prof. Harold Jacoby.
- Introduction to Astronomy (Adapted for Teachers of Geography). Prof. Harold Jacoby.
- Geodetic Surveying. Mr. William Bowie of the U. S. Coast and Geodetic Survey and assistant.
- Geographic Delineation and Map Interpretation. Asst. Prof. E. M. Lehnerts of the University of Minnesota.
- Physical Geography and Its Economic Aspects. Assoc. Prof. D. W. Johnson and Asst. Prof. E. M. Lehnerts.
- The Interpretation of Scenery. Assoc. Prof. D. W. Johnson.
- Physiography of the Western United States. Assoc. Prof. D. W. Johnson.
- Commercial Geography. Prof. C. T. McFarlane.
- Geography of Industry and Trade. Prof. C. T. McFarlane.
- Geographic Influences in American History. Prof. A. P. Brigham of Colgate University, Hamilton, N. Y.
- The Geography of New York State. Prof. A. P. Brigham.
- Economic History of the United States. Prof. E. L. Bogart of the University of Illinois.
- Field Work in Physiography in the Environs of New York City and the Eastern Section of New York State. Assoc. Prof. D. W. Johnson and Asst. Prof. E. M. Lehnerts.
- Field Work in Glacier National Park. Asst. Prof. E. M. Lehnerts. August 21–September 1 and September 2–14.
- Special Lectures: (1) The Philosophy of Present and Prospective Boundaries in Europe, Prof. A. P. Brigham; (2) Turkey and the War, Dr. Ellsworth Huntington of Yale University; (3) Surface Features of Europe as a Factor in the War, Assoc. Prof. D. W. Johnson; (4) An Interpretation of the Scenery of the White Mountains, Prof. J. W. Goldthwait of Dartmouth College; and (5) a series of three lectures on South America, Dr. Isaiah Bowman of the American Geographical Society.

Cornell University, Ithaca, N. Y. (July 9–August 17).
- Physical Geography. Asst. Prof. O. D. von Engeln.
- Commercial and Industrial Geography. Asst. Prof. O. D. von Engeln.
- Physical Geography, Laboratory Course. Mr. E. D. Elston.
- Field Course in Geography and Geology. Asst. Prof. O. D. von Engeln.
- Meteorology and Climatology. Mr. L. A. Hausman of the State College of Agriculture.
- Short local excursions; all-day excursions to Taughannock Gorge and Falls, July 14, Enfield Gorge and Falls, July 21, east shore of Cayuga Lake, August 11 (Prof. V. E. Monnett); and longer excursions to Niagara Falls and Gorge, July 28, and Watkins Glen, August 4.

Dartmouth College, Hanover, N. H. (July 10–August 18).
- Physiography. Prof. J. W. Goldthwait.
- Anthropology. Prof. H. P. Fairchild.

Harvard University, Cambridge, Mass. (July 2–August 11).
- Physiographic Field Studies. Prof. W. W. Atwood.
- Research in Structural or Glacial Geology. Assoc. Prof. J. B. Woodworth.
- Course in Field Geology in the Rocky Mountains of Montana. Assoc. Prof. J. B. Woodworth. July 6–August 17.
- Economic History of Europe and the United States during the Nineteenth Century. Prof. E. F. Gay.

University of Idaho (jointly with the Lewiston State Normal School), Moscow (June 12–July 24).
- Advanced Geography. Mr. C. S. Chessman of the Lewiston State Normal School.
- Geography for Teachers. Mr. C. F. Chessman.

Northern Illinois State Normal School, Dekalb (June 25–August 3).
- Geography. Miss Eva Southworth.
- Physical Geography. Miss Eva Southworth.
- The Teaching of Geography in the Higher Grades. Miss Eva Southworth.

Western Illinois State Normal School, Macomb (June 11–July 20).
- Advanced Physiography. Mr. E. L. Jay.
- Meteorology.
- Agricultural Geography.
- Relation of Geography to Human Life.
- Geography in the Grades. Mr. Herbert Bassett.

University of Illinois, Urbana (June 18–August 10).
Field Course in Geology in the Rocky Mountains in Eastern Wyoming. Prof. Eliot Blackwelder. June 20–August 15.
Plant Ecology. Dr. W. B. McDougall.

Indiana State Normal School, Terre Haute (June 18–August 31).
History of the Earth and Its Inhabitants. Prof. B. H. Schockel.
Planet, Earth, Climate. Asst. Prof. W. A. McBeth.
Elements of Geography.
Regional Geography.
North America. Asst. Prof. W. A. McBeth.
Economic and Commercial Geography. Prof. B. H. Schockel.
Historical and Regional Geography of Europe. Prof. B. H. Schockel.

Indiana University, Bloomington (June 14–August 10).
Physical Geography. Assoc. Prof. J. W. Beede.
Economic Geography. Assoc. Prof. J. W. Beede. June 11–August 24.
The Teaching of Geography. Mr. E. E. Ramsey.

University of Iowa, Iowa City (June 18–July 28 and July 30–August 25).
Physical Geography. Prof. A. C. Trowbridge and Mr. W. D. Shipton. First term.
Physical Geography. Dr. M. M. Leighton of Iowa State Teachers' College. Second term.
Geology of Soils. Prof. A. C. Trowbridge and Mr. W. D. Shipton. First term.
Field Course in Geology in the Baraboo, Wisconsin, District (co-operative with the University of Chicago). Asst. Prof. J. H. Bretz of the University of Chicago.
Field Course in Geology around Baraboo, Wisconsin. Prof. A. C. Trowbridge. August 1–31.

Johns Hopkins University, Baltimore, Md. (June 26–August 7).
Physical Geography. Mr. D. G. Thompson of Goucher College.
Economic and Commercial Geography. Mr. D. G. Thompson.

University of Kansas, Lawrence (June 7–July 18 and July 19–August 15).
Physiography. Prof. Erasmus Haworth. First term.
Summer Field Work. Asst. Prof. W. P. Haynes. First term.
Ethnology and Race Problems. Prof. F. W. Blackmar.

Western Kentucky State Normal School, Bowling Green (June 18–July 30).
Geographic Influences in American History. Miss E. C. Semple of Louisville, Ky.
Method in Teaching Geography.
Excursion to Mammoth Cave, June 15–21.

Louisiana State University, Baton Rouge (June 7–August 8).
Physiography. Prof. F. V. Emerson.
Geology and Geography of Louisiana. Prof. F. V. Emerson.

Miami University, Oxford, Ohio (June 11–July 20).
Home Geography. Prof. G. W. Hoke.
Geography of Eurasia. Prof. G. W. Hoke.
Geography of the United States. Mr. S. W. Cushing of the State Normal School, Salem, Mass.
World Geography. Mr. S. W. Cushing.

Central State Normal School, Mount Pleasant, Mich. (June 25–August 3).
Physiography. Mr. G. E. Ganiard, Superintendent of Schools, Mount Pleasant Mich.
Commercial Geography. Mr. R. D. Calkins.
Teachers' Geography. Mr. R. D. Calkins.
Geographic Methods. Mr. R. D. Calkins.

Michigan State Normal College, Ypsilanti (June 25–August 3).
An Elementary Course in Geography. Miss Mabel Weddel.
Physiography of the Lands. Miss Genevieve Clark.
Commercial Geography. Prof. Mark Jefferson.
Geography of Europe. Prof. Mark Jefferson.
Teachers' Geography. Miss Genevieve Clark and Miss Mabel Wedel.
Field Course in Geology in Southeastern Michigan. Prof. W. H. Sherzer.

University of Michigan, Ann Arbor (July 2–August 24).
Teachers' Course in Physiography. Asst. Prof. I. D. Scott and assistant.
Elementary Meteorology. Asst. Prof. I. D. Scott and assistant.
Excursion to Niagara Falls, July 20, and to the island of Put-in-Bay, Lake Erie, August 4. Asst. Prof. I. D. Scott.

University of Michigan (continued)
Special Lectures: (1) Geology of Niagara Falls, July 18, Asst. Prof. I. D. Scott; (2) Geography and Politics, August 6, Prof. R. G. Gettell of Amherst College; (3) The Eskimos of Southern Baffin's Land and of the Belcher Islands of Hudson Bay, July 25, Mr. R. J. Flaherty of Houghton, Mich.

Western State Normal School, Kalamazoo, Mich. (June 25–August 3).
General Geography. Mr. L. H. Wood.
The Geography of Michigan. Mr. L. H. Wood.
The Geography of South America. Mr. C. C. Wilcox of the Kalamazoo High School.
The Geography of Europe. Mr. L. H. Wood.
Commercial Geography. Mr. C. C. Wilcox.
The Geography of American History. Mr. C. C. Wilcox.
Review Geography. Miss Emilie Townsend.
Special Lecture: Physical Barriers and Economic Attractions Which Have Affected the Westward Movement in the United States. Prof. C. H. Van Tyne of the University of Michigan. July 3.

University of Minnesota, Minneapolis (June 19–July 31).
Physiography. Asst. Prof. C. J. Posey.
Teachers' Course in Geography. Asst. Prof. C. J. Posey.
Geography of Latin America. Asst. Prof. C. J. Posey.
Industries and Commerce of the United States. Mr. R. J. McFall.
Economic Geography of Foreign Countries. Mr. R. J. McFall.
Field Work in Glacier National Park. Asst. Prof. E. M. Lehnerts. June 18–July 2.

University of Missouri, Columbia (June 7 to August 3).
Fundamentals of Physical and Human Geography. Mr. M. E. Branom.
Geographic Influences in American History. Mr. M. E. Branom.
Advanced Commercial Geography. Mr. S. T. Bratton.
Geography of North America. Mr. M. E. Branom.
Geographic Field Trip to the Atlantic Coast. Mr. M. E. Branom. August 4–September 1.
Teachers' Geography. Mr. S. T. Bratton.
Economic History of the United States. Asst. Prof. H. A. Wooster.

University of Montana, Missoula (June 18–July 27).
Physiography. Prof. J. P. Rowe, and Mr. E. E. Holmes of the College of Montana, Deer Lodge, Mont.
Geography and Geology of Montana. Prof. J. P. Rowe and Mr. E. E. Holmes.

University of Nebraska, Lincoln (June 11–August 3).
Physical Geography. Miss C. J. Nelson of Teachers College High School.
Regional Geography of North America. Assoc. Prof. N. A. Bengtson.
Geography of European Countries. Assoc. Prof. N. A. Bengtson.
Geography of Nebraska. Assoc. Prof. N. A. Bengtson.
Commercial Geography. Prof. G. S. Stephens.
Elementary Geology, Physiographic, Structural, and Dynamical. Mr. R. W. Ellis.
Geological Excursion to the Black Hills and Rocky Mountain Region. Prof. E. H. Barbour and Asst. Prof. E. F. Schramm.

University of Nevada, Reno (June 19–July 30).
Review and Methods of Teaching Geography.

New York University, New York City (July 2–August 10).
Principles of Economic Geography. Mr. A. M. Nielson.
Special Topics in Geography. Prof. J. E. Woodman.
Research in Geography and Geology. Prof. J. E. Woodman.
Field Course in General Physiography and Geology. Prof. J. E. Woodman.

Northwestern University, Evanston, Ill. (June 25–August 4).
General Geology: Introduction to Geology and the Physiography of the Lands. Prof. U. S. Grant.
Geology and Physiography of the United States. Prof. U. S. Grant.
Race Studies. Prof. S. L. Chandler.

Oberlin College, Oberlin, Ohio (June 15–August 2).
Principles of Geography. Prof. G. D. Hubbard.
Physical, Commercial, and Historical Geography of England. Prof. L. B. Hall.
Ecology. Assoc. Prof. Lynds Jones.

Ohio State University, Columbus (June 21–August 16).
Field Ecology. Prof. E. N. Transeau.
The History of the Westward Movement to 1812. Prof. H. C. Hockett.

Ohio University and State Normal College, Athens (June 23–August 3).
Physiography. Prof. B. M. Thompson.
Physical Geography. Prof. B. M. Thompson.
Political Geography. Prof. B. M. Thompson.
Methods in Geography. Prof. C. L. Martzolff.
Commercial Geography. Asst. Prof. G. C. Parks.

University of Oklahoma, Norman (June 4–July 31).
Physical Geography. Mr. A. J. Williams, Mr. C. E. Decker, and Mr. E. W. Scudder.
Physiography. Mr. A. J. Williams.
Domestic and Foreign Commerce. Assoc. Prof. A. B. Adams.
Territorial Expansion of the United States. Prof. Roy Gittinger.

George Peabody College for Teachers, Nashville, Tenn. (June 16–July 20 and July 21–August 31).
General College Geography. Mr. C. O. Sauer of the University of Michigan.
Economic and Commercial Geography. Mr. C. O. Sauer.
Fundamentals of Regional Geography. Prof. A. E. Parkins.
Influence of Geography on American History, With Special Emphasis on the South. Prof. A. E. Parkins.
Geography of the South. Prof. A. E. Parkins.
The Geography and Commerce of South America. Asst. Prof. G. E. Snider of the College of the City of New York.
People and Industries of South America. Asst. Prof. G. E. Snider.
Geography of Europe. Mr. C. O. Sauer.
Course in Advanced Field Geography either in the southern part of the Appalachian Highland or the area about the Great Lakes. Late July and August, or September.

Pennsylvania State College, State College (June 25–August 3).
Physical Geography. Asst. Prof. L. J. Youngs.
Teachers' Geography. Asst. Prof. L. J. Youngs.
The Teaching of Geography and History. Miss A. U. Wert of the Teachers' Training School, Harrisburg, Pa.
Geography and History in Seventh and Eighth Grades. Miss A. U. Wert.
Economic History of the United States. Dr. A. E. Martin.

University of Pennsylvania, Philadelphia (July 10–August 18).
Physical Geography. Prof. W. M. Gregory of the Cleveland Normal Training School.
Commercial and Industrial Geography. Prof. W. M. Gregory.
The Teaching of Geography. Prof. W. M. Gregory.
Civics, Hygiene, and Geography [course for training of teachers for continuation schools]. Mr. L. A. Lettinger of the Philadelphia Trades School.
The Industrial Environment. Mr. C. E. Reitell.
History of the West, 1837–1873. Prof. L. Paxson of the University of Wisconsin.
The North American Indian. Mr. R. T. Aitken.
Peoples of the Pacific. Mr. R. T. Aitken.

Rhode Island Normal School, Providence.
Methods in Teaching Geography. Mr. R. M. Brown.
Advanced Work in Geography. Mr. R. M. Brown.

University of South Carolina, Columbia (June 20–July 19).
Physical Geography. Prof. A. C. Moore.

University of South Dakota, Vermillion (June 18–July 27).
Geography and the Teaching of Geography. Mr. M. C. Helm, Superintendent of Schools, Pierre, S. D.
Physical Geography and the Teaching of Physical Geography. Mr. M. C. Helm.
Economic Geography. Mr. A. M. Peisch.

Syracuse University, Syracuse, N. Y. (July 9–August 17).
Physiography. Asst. Prof. A. E. Brainerd and Asst. Prof. B. W. Clark.
Physiography of the United States. Asst. Prof. A. E. Brainerd and Asst. Prof. B. W. Clark.
Climatology. Asst. Prof. A. E. Brainerd and Asst. Prof. B. W. Clark.
Industrial and Commercial Geography. Prof. F. W. Roman.
Industrial History of the United States. Asst. Prof. O. E. Randall.
History and Geography of the South American Republics. Prof. A. S. Patterson.

University of Tennessee: Summer School of the South, Knoxville (June 19–July 27).
Home and World Geography (for primary teachers). Miss Bertha Henderson of the Humboldt State Normal School, Arcata, Cal.

University of Tennessee (continued)
- North America (for teachers of grammar grades). Miss Bertha Henderson.
- Review of Geography. Miss Bertha Henderson.
- Geography, History, and Nature Study (for teachers of first four grades). Miss M. L. Cooper of the Memphis city schools.

University of Texas, Austin (June 13–July 26 and July 26–September 4).
- General Geography. Mr. E. G. Littlejohn of the Alamo School, Galveston.
- Physical Geography. Mr. E. G. Littlejohn.
- Geographic Influences in History. Prof. W. L. Fleming of the Louisiana State University. First term.

Tulane University of Louisiana, New Orleans (June 11–July 21).
- Geography [principles and teaching methods]. Mr. C. C. Hensen, Principal of the Newman Normal Training School, New Orleans.

University of Utah, Salt Lake City (June 11 to July 20).
- Nature-Geography, Story, and Civics [primary teaching methods]. Asst. Prof. Anna Youngberg.
- Geography for Grammar Grades. Asst. Prof. Anna Youngberg.
- Western History [general development of the Far West from 1790 to the present]. Prof. L. E. Young.

University of Virginia, Charlottesville (June 19–August 2).
- Physical Geography. Miss L. C. Kelley of the John Marshall High School, Richmond, Va.
- Industrial and Commercial Geography. Miss L. C. Kelley.
- Latin American Social Development [a study of the human geography of the Latin-American States]. Adjunct Prof. J. C. Bardin.

University of Washington, Seattle (June 16–July 27).
- Physical and Regional Geography. Asst. Prof. E. J. Saunders.
- Meteorology and Climatology. Asst. Prof. E. J. Saunders.
- Economic Geography of Washington. Prof. Henry Landes.
- The Trade of the Pacific. Dr. G. M. Janes.
- Spanish-American Civilization. Assoc. Prof. G. W. Umphrey.
- Special Lectures: (1) Climatic Peculiarities of Washington; (2) Vulcanism Along the Pacific Coast; (3) Yellowstone Park; and (4) Glacier National Park. Asst. Prof. E. J. Saunders.

University of Wisconsin, Madison (June 25–August 3).
- Physical and Applied Geography. Assoc. Prof. Lawrence Martin.
- Glaciers and Glaciation. Assoc. Prof. Lawrence Martin.
- Commercial and Industrial Geography. Prof. R. H. Whitbeck.
- Geography of Wisconsin. Assoc. Prof. Lawrence Martin.
- Geography of South America. Prof. R. H. Whitbeck.
- Field Course in Physiography and Geology at Devil's Lake, Wisconsin. Assoc. Prof. Lawrence Martin.

Personal

Professor A. P. Brigham of Colgate University has in preparation a volume on the geography of New York State.

Dr. C. F. Brooks of Yale University will be engaged this summer in the Office of Farm Management of the U. S. Department of Agriculture in the application of seed-time and harvest maps to this summer's movement of farm labor.

Professor H. C. Cowles of the University of Chicago lectured on May 11 before the Geographic Society of Chicago on "The Trees of California: A Riddle in Forest Geography."

Mr. G. C. Curtis' model of the crater of Kilauea, Hawaii, has been installed in the geological section of the Harvard University Museum and was put on public exhibition on May 26.

Professor W. M. Davis was awarded the gold Hayden Memorial Medal on February 20 by the Academy of Natural Sciences of Philadelphia "in recognition of his distinguished work in geological science." Professor Davis is for the present occupied with work connected with the Geography Committee of the National Research Council, which has interrupted the completion of his report on the origin of coral reefs, following his Pacific voyage of 1914.

Professor C. R. Dryer is planning this summer to complete his field and research

studies in the physical and economic geography of Indiana and to prepare the results for publication.

Dr. O. L. Fassig of the U. S. Weather Bureau station in Baltimore went to San Juan, Porto Rico, in April on a special mission to extend and reorganize the Weather Bureau service in the West Indies. Meteorological stations are to be established in the newly acquired Virgin Islands and in Haiti, two in the western division of the island and one in the Dominican Republic, at Puerto Plata. The station in San Juan will probably become the center of the West Indian meteorological service.

Professor G. D. Hubbard of Oberlin College is engaged in the preparation of a "Physiography of Ohio."

Captain Gunnar Isachsen, who was a member of Sverdrup's second *Fram* expedition of 1898-1902, recently arrived from Christiania to spend several months in this country. It was Captain Isachsen who on this expedition surveyed Ellef and Amund Ringnes Islands and after whom is named the northwestern cape of the former island, the point jutting farthest into the unknown from this part of the American Arctic Archipelago.

Professor D. W. Johnson of Columbia University is giving, in addition to the summer courses noted elsewhere in this number, a course on "Map Reading and Map Interpretation" in the series of war emergency courses being conducted at Columbia University from May 8 to June 9. This course will be repeated later in the Summer Session. On May 21 Professor Johnson addressed the New York Academy of Sciences on "The Influence of Topography on the Rumanian Campaign." The subject-matter of the address was similar to that of Professor Johnson's article in this number.

Mr. P. Lee Phillips, Chief of the Division of Maps and Charts of the Library of Congress, has completed in manuscript a bibliographical account entitled "The First Map and Description of Ohio, 1787, by Manasseh Cutler," to be published by Lowdermilk and Co. in their "Rare Map Series," and "A List of Maps and Atlases Applicable to the World War."

Mr. J. W. Redway, the author of well-known geographical text books, is at present engaged in researches on the dust content of the air and its relation to the spread of sporadic diseases. His results are being published mainly in medical journals.

Mr. W. G. Reed, who is at present attached to the Portland, Oregon, office of the U. S. Weather Bureau, is carrying out investigations in the Pacific Northwest to determine the efficiency of the various methods for protecting fruit and vegetables from frost.

Professor H. F. Reid of Johns Hopkins University has been in Europe since the latter part of April as a member of a commission of six sent jointly by the Advisory Commission of the Council of National Defense and the National Academy of Sciences. Professor Reid will study problems connected with photographic surveying from aëroplanes.

Dr. V. E. Shelford of the University of Illinois will spend the summer investigating the effects of climatic factors on the development of insect pests under the auspices of the Illinois State Laboratory of Natural History. The work will be carried on with the enlarged facilities afforded in the new University Vivarium, where various climatic conditions can be simulated.

Mr. Eugene Van Cleef of the Duluth, Minnesota, State Normal School is undertaking this summer a regional study of the Bayfield Peninsula and the Apostle Islands, Wisconsin.

Professor Robert DeC. Ward of Harvard University will give instruction in meteorology in the new school for the preliminary training of aviators, recently established at the Massachusetts Institute of Technology in co-operation with the War Department. In order to carry on this work, Professor Ward has been made a member of the teaching staff of the institute, at the same time retaining his position and carrying on his regular instruction at Harvard. Under orders from the War Department he visited Toronto early in May for the purpose of securing information regarding the instruction which is given there at the school for the preliminary training of aviators carried on by the Royal Flying Corps.

Mr. E. H. Wilson of the Arnold Arboretum of Harvard University is engaged in a botanical expedition to eastern Asia. He left the United States in January and expects to return in March or April, 1918. He went first to Japan, then made a journey to the Riu Kiu Islands, a group which has been little visited by botanists. Returning to Japan he visited Oshima Island, a volcanic island south of Yokohama. He is at present in Korea, where he is going to pass the summer and early autumn, and then expects to visit Formosa.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

United States

North-Central States

Weld, L. D. H., and others. **Studies in the marketing of farm products.** 113 pp.; ills. *Univ. of Minnesota Studies in Social Sci. No. 4.* Minneapolis, 1915. 10 x 7.

Beginning with a general discussion of "Market Distribution," this instructive publication treats in detail the marketing of live-stock products, potatoes, and poultry, with special reference to Minnesota; the distribution of milk in Minneapolis and St. Paul; the city market of Minneapolis; co-operative marketing of grain in western Canada; and the food supply of the Iron Range. The basis for the discussion throughout the volume lies in the declaration that "marketing is a part of production," an assumption which the senior author says has not received sufficient recognition by economists.

In the marketing of many foodstuffs, "the part played by transportation costs is almost insignificant when considered as a proportion of final retail prices." Statistics are presented to demonstrate that, in general, the farmer receives 60 per cent of the price for which his product retails. The advantages to be derived from co-operative farming are strongly emphasized and well supported by data.

In many respects the chapter that analyzes "The Food Supply of the Iron Range" is most interesting. The towns are more numerous and are closer together than any other group in the state. On the other hand they are farther from the food-producing area than any other towns. Their presence is due wholly to the iron mines. Since agriculture as yet is a negligible factor, all food supplies must be shipped in. The cost of living on the Range is about 10 per cent higher than in Minneapolis and St. Paul. E. Van Cleef.

Alexander, W. H. **Climatological data: Ohio section.** Maps. *Climatological Data,* Vol. 21, 1916, No. 4 (April), pp. 27-30; No. 6 (June), pp. 43-48; No. 7 (July), pp. 51-56; No. 8 (August), pp. 59-64; No. 9 (Sept.), pp. 67-72; No. 10 (Oct.), pp. 75-80. Weather Bureau, Washington, D. C.

Alvord, J. W., and C. B. Burdick. **Report of the Rivers and Lakes Commission on the Illinois River and its bottom lands, with reference to the conservation of agriculture and fisheries and the control of floods.** 141 pp.; maps, diagrs., ills. Springfield, 1915.

Boyle, J. E. **Notes from an agricultural field trip across North Dakota.** *Quart. Journ. of the Univ. of North Dakota,* Vol. 7, 1917, No. 2, pp. 177-183.

Cady, G. H. **Coal resources of District VI.** 94 pp.; maps, diagrs., ills., index, bibliogr. *Illinois Geol. Survey Bull. No. 15.* Urbana, 1916. [District VI embraces Jefferson and Franklin Counties and the northern tier of townships in Williamson.]

Cady, G. H. **Mineral production of Illinois in 1909 and 1910.** *Illinois Geol. Survey Bull. No. 20,* pp. 19-42. Urbana, 1915.

Case, E. C., and W. I. Robinson. **The geology of Limestone Mountain and Sherman Hill in Houghton County, Michigan.** Map, diagrs. *Michigan Geol. and Biol. Survey Publ. 18: Geol. Ser. 15,* pp. 167-181. Lansing, 1915.

Cooper, T. P., F. W. Peck, and Andrew Boss. **Labor requirements of crop production.** 55 pp.; diagrs. *Univ. of Minnesota Agric. Exper. Station Bull. 157.* St. Paul, 1916. ["The data herein presented show the actual labor requirements of farm crops in terms of man- and horse-hours per acre and define some of the principles underlying the use of man labor on the farm."]

Fritsch, W. A. **German settlers and German settlements in Indiana.** 62 pp. [The Speed Press], Evansville, Ind., 1915. 50 cents. 7 x 5.

Hersey, H. B. **Climatological data: Wisconsin section.** Maps. *Climatological Data,* Vol. 21, 1916, No. 2 (February), pp. 11-14; No. 3 (March), pp. 19-22. Weather Bureau, Washington, D. C.

HOLAND, H. R. **A forgotten community: A record of Rock Island, the threshold of Wisconsin.** *Proc. State Hist. Soc. of Wisconsin at its Sixty-Third Annual Meeting held October 21, 1915*, pp. 140-150. Madison, 1916. [Island about a mile square in Green Bay, now abandoned, but 70 years ago the home of a vigorous fishing community.]

KAY, F. H., AND K. D. WHITE. **Coal resources of District VIII (Danville).** 68 pp.; maps, diagrs., ills. *Illinois Geol. Survey Bull. No. 14.* Urbana, 1915.

LEE, WALLACE. **The geology of the Rolla Quadrangle.** xii and 111 pp.; maps, diagrs., ills., index. *Missouri Bur. of Geol. and Mines*, Vol. 12, Second Series. Jefferson City, Mo., 1913. [Accompanied by original geological map, 1:62,500.]

MERANDO, SALVATORE. **Gl' Italiani a Chicago.** *Riv. Coloniale*, Vol. 11, 1916, No. 9, pp. 472-478.

MILLER, M. F. **The control of soil washing.** 12 pp.; ills. *Univ. of Missouri Agric. Exper. Station Circular No. 78.* Columbia, 1915.

MILLS, W. C. **Exploration of the Tremper mound (Portsmouth, Ohio).** Maps, diagrs., ills. *Ohio Archæological and Historical Quart.*, Vol. 25, 1916, No. 3, pp. 263-398.

MURPHY, MAURICE. **Some features of the history of Parke County [Indiana].** *Indiana Mag. of Hist.*, Vol. 12, 1916, No. 2, pp. 144-157.

O'BRIEN, F. A. **Names of places of interest on Mackinac Island, Michigan, established, designated, and adopted by the Mackinac Island State Park Commission and the Michigan Historical Commission.** 85 pp.; map, diagr., ills. *Michigan Hist. Commission Bull. No. 5.* Lansing, 1916.

PIERCE, E. D., G. H. SQUIER, AND L. P. KELLOGG. **Remains of a French post near Trempealeau.** Ills., bibliogr. *Proc. State Hist. Soc. of Wisconsin at its Sixty-Third Annual Meeting held October 21, 1915*, pp. 111-123. Madison, 1916. [Probable site of the first (1685-86) and last (1750-55) of the French posts on the Upper Mississippi.]

QUAIFE, M. M. **Index to volumes I-XX of the Wisconsin Historical Collections.** vi and 573 pp. *State Hist. Soc. of Wisconsin Colls.*, Vol. 21, 1915. Madison.

—— **St. Paul, City of: Annual report of the commissioner of public works for the year ending December 31, 1915.** 180 pp.; maps, diagrs. Dept of Public Works, St. Paul, 1915. [Contains several maps of the city, about 1:27,000, giving various data which may be of value in city geography.]

SHAW, E. W. **Newly discovered beds of extinct lakes in southern and western Illinois and adjacent states.** Maps, diagrs. *Illinois Geol. Survey Bull. No. 20*, pp. 139-157. Urbana, 1915. [A more complete presentation than the "Preliminary Statement Concerning a New System of Quaternary Lakes in the Mississippi Basin," *Journ. of Geol.*, Vol. 19, 1911, No. 6.]

SMITH, J. W., AND C. A. PATTON. **Ohio weather for 1915.** Maps, diagrs. *Ohio Agric. Exper. Station Bull. No. 296*, pp. 349-428. Wooster, 1916.

—— **Soil survey reports of Waushara, Waukesha, Iowa counties, Bayfield area, and north part of northwestern Wisconsin.** 394 pp.; maps, ills. **Soil survey reports of Fond du Lac, Juneau, Wewaunee, and La Crosse counties.** 339 pp.; maps, ills. *Wisconsin Geol. and Nat. Hist. Survey Bulls. Nos. 28 and 37, Soil Sur. Nos. 2-6 and 7-10.* Madison, 1913 and 1914.

STEWART, W. P. **Climatological data: Wisconsin section.** Maps. *Climatological Data*, Vol. 21, 1916, No. 10 (Oct.), pp. 75-78. Weather Bureau, Washington, D. C.

VAN DER ZEE, JACOB. **Episodes in the early history of the Des Moines Valley.** *Iowa Journ. of Hist. and Politics*, Vol. 14, 1916, No. 3, pp. 311-347.

WHYTE, W. F. **The settlement of the town of Lebanon, Dodge County.** *Proc. State Hist. Soc. of Wisconsin at its Sixty-Third Annual Meeting held October 21, 1915*, pp. 99-100. Madison, 1916. [The early settlers of Lebanon were lineal descendants of Salzburg emigrants who to escape religious persecution in Austria removed to Brandenburg in the early eighteenth century. For a like reason their descendants emigrated to America a century or more later.]

SOUTH AMERICA

ECUADOR, PERU, BOLIVIA

FERRIS, H. B. **The Indians of Cuzco and the Apurimac.** Map, ills. *Memoirs Amer. Anthropological Assoc.*, Vol. 3, 1916, No. 2, pp. 59-148.

HANDLEY, W. H. **Peru.** 24 pp. *Suppl. to Commerce Repts.*, Ann. Series, 1916, No. 46a, Bur. of Foreign and Domestic Commerce, Dept. of Commerce, Washington, D. C.

HANN, J. v. **Der tägliche Gang des Luftdruckes zu Quito und am Äquator überhaupt.** *Meteorol. Zeitschr.*, Vol. 33, 1916, No. 2, pp. 69-75.

JIMENEZ, C. P. **Estadística minera en 1914.** 150 pp. *Bol. Cuerpo de Ingenieros de Minas del Perú No. 82.* Minist. de Fomento, Lima, 1916.

MARIE, VICTOR. **La producción de algodón en el Perú.** *Bol. del Minist. de Fomento,* Vol. 14, 1916, No. 1, pp. 25-94. Lima. [Reproduced from Bulletin No. 4, 1904.]

REID, W. A. **Bolivia: The heart of a continent.** 53 pp.; map, ills. Bolivian Legation, Washington, D. C., 1916.

—— **Titicaca, La agricultura en la altiplanicie del.** *Bol. del Minist. de Fomento,* Vol. 14, 1916, No. 2, pp. 49-88. Lima. [Discussion of the possibilities of improvement in cultivation of the Titicaca region in view of certain agricultural experiments conducted during the years 1913-1914 and 1914-1915.]

—— ***Cerro Azul Bay, Peru. From a British survey in 1838.*** 1:25,500. *U. S. Hydrogr. Office Chart No. 1757.* Washington, D. C., July, 1916.

—— ***Ecuador, Ferrocarril transamazonico del.*** 1:10,000. Sindicato-Franco-Ecuatoriano de Paris, 1914.

—— ***Talara Bay, Peru. From a British survey in 1909.*** 1:75,000. *U. S. Hydrogr. Office Chart No. 2562.* Washington, D. C., July, 1916.

POLAR REGIONS

ARCTIC

NANSEN, FRIDTJOF. **Spitsbergen waters: Oceanographic observations during the cruise of the "Veslemöy" to Spitsbergen in 1912.** 132 pp.; maps, diagrs., ills., bibliogr., index. *Videnskapsselskapets Skrifter: I, Mat.-Naturv. Klasse,* 1915, No. 2. Christiania.

The Scandinavians have done some of the best work in oceanography—among them Dr. Nansen, zealous, keen observer, critical analyst of data, careful weigher of deductions. This contribution to science is of great value. He views the ocean, as the geologist views the land, as a mass of strata of different thicknesses, horizontal, inclined, with anticlines and synclines and large lentical-shaped sections interlocking like the regenerated drift in glacial gravel beds. This condition is largely due to differences in temperature, varying degrees of salinity, movement of ocean currents, whether tidal, wind-formed, or true currents.

The large number of sections given in the book showing vertical distribution of salinity, isopycnals, and thermal variations are illuminating, and reveal the vast amount of sounding and other investigations necessary for their plotting.

During the northward course of the expedition, several vertical series of observations were made. These demonstrated the tendency of bank-water towards vertical uniformity and showed that these homogeneous masses of water remain over the banks far into the summer. The larger and more shallow the bank, the longer the mass remains. In this conclusion we find food for thought relative to the effect of the bank-water upon the circulation of the Polar Current in the section north of Siberia and possibly an explanation of the excessive zig-zag drift of the *Jeannette* over that of the *Fram*.

The numerous observations made of the Spitzbergen-Atlantic Current for temperature at all depths down to 400 meters and an examination of the water salinity indicate a general law, "that when the temperatures of the deep layers of the sea west or northwest of Spitsbergen decrease towards 1° C., or lower, the salinity has a tendency to approach 34.92‰." The same data compared with similar observations made in this area in 1905 show that the Spitzbergen-Atlantic Current had more of an Atlantic character in 1905 than in 1912.

Dr. Nansen found considerable variations in short periods of time of the water strata in the western and northern Spitzbergen fiords, due undoubtedly to horizontal circulation, which in turn was influenced by the tide. The chief cause of the difference in temperature lies in the water on the shelf outside of the fiords and is influenced by the Spitzbergen-Atlantic Current running west around South Cape, and then north as far as Cross Bay.

One point stands out in this work that should be emphasized, namely, that melting ice on the surface has little or no effect upon the underlying strata, as demonstrated by the vertical section of temperatures and salinity percentages made within 100 meters of Lilliehöök Glacier. Here is a subject for further investigation wherever glaciers of considerable size reach the sea. It is the custom of sea captains to "smell icebergs" with thermometers in foggy weather, but they deal only with a thin surface layer shifted with the wind.

Ice prevented penetration into the Deep Polar Basin north of Spitzbergen, but north of Hinlopen Strait Nansen discovered, at 620 meters, a channel evidently communicating with the Polar Basin. The water observed down to 500 meters indicated Atlantic origin and the water below this depth came from the Deep Polar Basin. Nansen draws the conclusion that "The salinity of the water of the Deep Polar Basin is identical with the salinity of the deep-water of the Norwegian Sea."

Under the heading "Extension and Shape of the North Polar Basin" Dr. Nansen gives an illuminating discussion of the work of the *Fram* expedition and criticizes the work of Rollin A. Harris relative to hypothetical land north of Alaska, west of Banks Land and north of Axel Heiberg Land, stating that such land cannot be so near known coasts as assumed by Mr. Harris.

The tides in the North Polar Basin are discussed at length but chiefly from data obtained outside of this particular expedition. Dr. Nansen reviews the data of the famous *Fram* drift of 1896, modifying some of his former conclusions and stating that ice pressures, in the broadest view, are the results of high tides and that much of the slack ice is due to slack water. Here he introduces a discussion of spring and neap tides and their coincidence with high and low ice pressures in the Deep Polar Basin. Indications are that tidal waves in the Deep Polar Basin are larger than have been assumed.

This is a most interesting portion of the treatise. The question can hardly be fully settled by deductions from the data at hand. The drifts of the *Jeannette* and the *Fram* gave a clue to the probable deep water north of the Siberian continental shelf. The drift of the Bryant-Melville casks (as pointed out by the writer of this review in 1907) indicates a shorter route from Alaskan waters to the Greenland-Spitzbergen Passage than that taken by the *Fram*. It indicates a more northern drift of true current character, consequently a broader and deeper basin underlying the casks. This conclusion is substantiated in Nansen's present discussion.

The study of northern oceanography has arrived at the point where a new drift, like the famous *Fram* drift, across the Polar Basin is desirable. This should be much to the northward of the *Fram* route. This was the route that Dr. Nansen intended to follow but he was caught in the ice on the continental Siberian shelf too far to the west.

A final chapter treats of the amount of oxygen in Spitzbergen waters, with some observations on the hydrogen ion concentration in northern sea water. The large number of tables and the 69 scale diagrams, all plotted from Dr. Nansen's soundings, make this work of permanent value to students of oceanography. W. S. C. RUSSELL.

BACKLUND, H. **Quelques données sur l'île de la Solitude (Ensomhed).** *Bull. de l'Acad. Imp. des Sci.* [*de Pétrograd*], 1916, No. 11, pp. 913-919. [In Russian.]

CRAIG, R. M. **Outline of the geology of Prince Charles Foreland, Spitsbergen.** Ills. *Trans. Edinburgh Geol. Soc.*, Vol. 10, 1916, Part 3, pp. 276-287.

—— **Davis Strait and Baffin Bay, Meteorology of.** *Symons's Meteorol. Mag.*, No. 607, Vol. 51, 1916, pp. 100-101. [Abstract of a paper by Captain Campbell Hepworth read at a meeting of the Challenger Society, May 31, 1916.]

HARBOE, E. G. **Das Erdbebenobservatorium auf der Disko-Insel.** *Beiträge zur Geophysik*, Vol. 14, 1915, Second Part, No. 2, pp. 35-31. [Continuation of report in Vol. 11, 1911, Second Part, pp. 9-28.]

HOEL, ADOLF. **Résultats de l'expédition norvégienne au Spitsberg en 1914.** Map. *La Géogr.*, Vol. 30, 1914-15, No. 4, pp. 277-279. Paris.

LEVASSEUR, N. **Chez les Esquimaux.** Ills. *Bull. de la Société de Géogr. de Québec*, Vol. 10, 1916, No. 3, pp. 143-146. [A note on the labors of Fabien Vanasse, historiographer to the exploring expeditions conducted by Captain Bernier in 1908-9 and 1910-11 (see "Report on the Dominion Government Expedition to the Northern Waters and Arctic Archipelago of the D. G. S. 'Arctic' in 1910," Ottawa, n. d.). M. Vanasse made a census of the Eskimo groups inhabiting Baffin Land and the south shores of Hudson Strait.]

MATHEY-DUPRAZ, A. **Un voyage dans l'Arctique.** Map. *Bull. de la Soc. Neuchateloise de Géogr.*, Vol. 24, 1915, pp. 5-23.

Peach, A. M. The preglacial platform and raised beaches of Prince Charles Foreland. Map, ills. *Trans. Edinburgh Geol. Soc.*, Vol. 10, 1916, Part 3, pp. 289-307.

Rasmussen, Knud. De første Thule-Ekspedition frem og tilbage over Inlandsisen. Maps, ills. *Ymer*, Vol. 35, 1915, No. 2, pp. 133-163.

Speerschneider, C. I. H. Nautisk-Meteorologisk Aarbog (Nautical-Meteorological Annual), 1914. 156 pp.; maps. 1915: 169 pp.; maps. Det Danske Meteorol. Inst., Copenhagen, 1916. [Of special interest on account of the colored maps showing the state of the ice and its geographical limits in the Arctic seas in the period from May to August inclusive, 1914 and 1915.]

Stephan, Julius. Die Schmetterlingswelt der Polarregionen. *Himmel und Erde*, Vol. 27, 1916, No. 10, pp. 388-393.

—— *Spitsbergen, Farvand og ankerpladser paa vest- og nordkysten; optat av Ritmester Isachsens norske Spitsbergenekspedition med marinens D. S. "Fram" 1909-10.* 1:2,500,000. With inset maps. 1, Forland Sundat—Kings Bay—Cross Bay, 1:200,000; 2, Blomstrand Hamn, 1:25,000; 3, Ferrier Hamn, 1:25,000; 4, Fram Hamn, 1:25,000; 5, Vulkan Hamn, 1:25,000; 6, Green Harbour, 1:100,000; 7, Hecla Hamn—Finnes Hamn i Green Harbour, 1:25,000; 8, Norske Hamna paa Bjørnøya, 1:25,000. Norges Geografiske Opmaaling, Christiania, 1912.

MATHEMATICAL GEOGRAPHY

General

De Sitter, W. On the mean radius of the earth, the intensity of gravity, and the moon's parallax. *Proc. Section of Sciences, Kon. Akad. van Wetenschappen te Amsterdam*, Vol. 17, Part 2, pp. 1291-1295. June, 1915.

Paresce, René. Une nouvelle méthode de prévision du temps. Diagrs. *La Nature*, No. 2243, 1916, Sept. 23, pp. 197-199.

Schoy, C. Mittagslinie und Qibla: Notiz zur Geschichte der mathematischen Geographie. Diagrs. *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1915, No. 9, pp. 558-576.

Taylor, G. I. Skin friction of the wind on the earth's surface. *Proc. of the Royal Soc.*, Series A, Vol. 92, 1916, No. 637, pp. 196-199. [The term "skin friction," taken from mechanics, is here used to express the tangential force exerted by the wind as it blows over a large tract of land.]

Zeleny, Anthony. The dependence of progress in science on the development of instruments. *Science*, No. 1102, Vol. 43, 1916, Feb. 11, pp. 185-193.

Surveying and Geodesy

Nelles, D. H. Photogrammetry for taking topography of watershed. Diagr. *Engineering News*, Vol. 76, 1916, Nov. 9, pp. 878-880.

Stuart, M. V. The engineer's level. Diagrs. *Cairo Scientific Journ.*, No. 99, Vol. 8, 1914, pp. 263-272. Cairo.

Timerding, H. E. Die Ortsbestimmung auf See. Maps, diagrs. *Die Naturwissenschaften*, Vol. 4, 1916, No. 3, pp. 29-35.

PHYSICAL GEOGRAPHY

Meteorology and Climatology

Quayle, E. T. A graphical method of showing the daily weather, and especially cloud types. 6 pp.; map, diagr. *Commonwealth Bur. of Meteorol. Bull. No. 12.* Melbourne. ["The essence of the method is simply to make a rough diagrammatic pen sketch of the cloud as it would appear in section . . . and show the apparent relative levels of the clouds by giving a definite value to the vertical scale of the diagram."]

Shaw, Napier. Note on Mr. Bonacina's paper "On the re-adjustment of pressure differences: Two species of atmospheric circulation and their connection." *Quart. Journ. Roy. Meteorol. Soc.*, No. 180, Vol. 42, 1916, pp. 229-231.

Swann, W. F. G. On the ionization of the upper atmosphere. *Terrestr. Magnet. and Atmosph. Electr.*, Vol. 21, 1916, No. 1, pp. 1-8.

WENGER, R. **Über den Einfluss der Instrumentalfehler auf die synoptische Darstellung aerologischer Simultanaufstiege.** 16 pp.; diagrs. *Veröffentl. des Geophysikal. Inst. der Univ. Leipzig,* 2nd Series, No. 1. Leipzig, 1913.

HUMAN GEOGRAPHY

ANTHROPOGEOGRAPHY

PETRIE, W. M. FLINDERS. **The revolutions of civilisation.** xi and 136 pp.; diagrs., ills., index. (Series: Harper's Library of Living Thought.) Harper & Brothers, London and New York, 1911. 75 cents. 7 x 4½.

Dr. Petrie in this book propounds a theory, based on the evidences of archeology and of history, which appears to be fundamentally new. Published three years before the start of the great conflagration, the theory seems almost a Cassandra-like prediction of the present upheaval. The book is so "full of meat" that in a short review it is impossible to touch on many of its various points or to do more than briefly to indicate its general trend.

Petrie's main idea is that what we call civilization proceeds in a regular cycle, from a low stage of culture to a high stage of culture, then back again to a low stage of culture. The high stages of culture of various races throughout the world do not coincide. For instance, when feudal central Europe was in a state akin to barbarism, Arab civilization was flourishing in Spain and North Africa.

Each cycle of civilization of a race follows a regular course. On emerging from barbarism, the first product to attain fruition is sculpture, followed in turn by painting; then by literature, then by mechanics and science, then by wealth; after which civilization goes to pieces and returns to barbarism. Government also keeps abreast with civilization in a regular course. It is first an autocracy, then an oligarchy, then a democracy. "When democracy has attained full power, the majority without capital necessarily eat up the capital of the minority, and the civilization steadily decays, until the inferior population is swept away to make room for a fitter people."

Petrie has traced the civilization of Egypt through eight cycles, each of which becomes less distinct as it is further back from us. The seventh Egyptian period corresponds with the last period of European civilization, which brought forth the great sculptures of Greece about 450 B. C., and which ended with the fall of the Roman Empire about 450 A. D. Our own cycle begins with the darkness of the Middle Ages. Gothic sculpture reaches a high stage of development about 1200 A. D., painting about 1400, literature about 1600, mechanics and science about 1900. Judging from precedent—were it not for the Great War—wealth should have a chance of increasing for a hundred or two hundred years more.

Petrie's book arouses a pessimistic and hopeless feeling of the strongest kind about coming generations. For whatever may be the outcome of the present cataclysm it is certainly rushing to destruction the wealth of Europe and of North America. It may be that we are already over the edge, tumbling back to anarchy and barbarism!

EDWIN SWIFT BALCH.

ECONOMIC GEOGRAPHY

General

MITCHELL, W. C. **Business cycles.** xviii and 610 pp.; diagrs., index. *Memoirs Univ. of California, Vol. 3.* Univ. of California Press, Berkeley, 1913. 13 x 10.

Geographers must view with pleasure the extent to which economists are recognizing the importance of the science of geography. A recent review (*Geogr. Rev.,* Vol. 1, p. 192) of Moore's book on "Economic Cycles" showed the close relationship between the average production of crops per acre and the prices of commodities. It also showed that the relationship between crop production and prices is suddenly disturbed at times of panic. The present volume was written before that of Moore, but has not hitherto been noticed in this *Review.* It is interesting as preparing the way for Moore's book and at the same time as giving a comprehensive review of the mechanism of business cycles and of the sudden break which comes at times of panic. The author does not go so far as Moore in attributing the ebb and flow of business to crops, but this seems to be largely because he has not gone into the question of crops so carefully. His main point is that a variation in the production of any commodity or crop disturbs other lines of business and that thus prices may be caused either to rise or fall according to the nature of the disturbances. In his summary he puts the matter thus:

"Many of these divergences among business cycles are due to events which arise

from other than business sources. For the mechanism of the money economy is so delicate that someone's prospects of profits are affected by every day's news. Most important of all these extraneous factors in the long run are the changes of the weather which make crops good or bad, and so affect the prices of farm products, the purchasing power of agricultural communities, the earnings of 'granger' railways, etc.'' He adds that: ''The making of war or of peace, disturbances of domestic order, earthquakes, conflagrations, epidemics, changes in monetary standards, tariff revisions, governmental policies regarding corporations, alterations in the gold output, improvements in industrial technique, the shifting of trade routes—these and a thousand other things can scarcely fail of helping or hampering some business venture. If the circle which they reach be large and their effects pronounced, they doubtless give a peculiar twist to the business cycle within which they fall.''

It is noticeable that as the result of a long, exact, and most painstaking study, Mr. Mitchell comes to the conclusion that although such things as war, domestic disorder, tariffs, changes in banking systems, and other things may temporarily cause grave fluctuations in commerce, the crops stand by themselves as the one great cause whose fluctuations man cannot control and which are bound to occur in all parts of the world. While Mr. Mitchell's book consists largely of an economic study of variations in prices, production, imports, bank clearings, employment, manufactures, currency, and other factors, it is well worth study by the geographer who wishes to see how his science is related to daily life. ELLSWORTH HUNTINGTON.

CLARK, J. B. **[The theoretical side of] The economic costs of war.** *Amer. Econ. Rev.: Suppl.*, Vol. 6, 1916, No. 1, pp. 85-93. [Paper read at the 28th Annual Meeting of the Amer. Econ. Assoc., Washington, D. C., Dec., 1915.]

LANE, F. K. **The contest with physical nature.** *Science*, No. 1101, Vol. 43, 1916, Feb. 4, pp. 158-159. [Address by the Secretary of the Interior before the Mining and Geological Section of the Pan-American Scientific Congress, Washington, D. C., Dec., 1915-Jan., 1916.]

MAVOR, JAMES. **Applied economics: A practical exposition of the science of business with illustrations from actual experience.** xxi and 487 pp.; index. Alexander Hamilton Institute, New York, [1914]. 8½ x 5. [Chapters on the economics of agriculture, production, and transportation.]

ROSSITER, W. S. **The statistical side of the economic costs of war.** *Amer. Econ. Rev.: Suppl.*, Vol. 6, 1916, No. 1, pp. 94-117. [Paper read at the 28th Annual Meeting of the Amer. Econ. Assoc., Washington, D. C., Dec., 1915.]

WHITBECK, R. H. **Economic geography: Its growth and possibilities.** *Journ. of Geogr.*, Vol. 14, 1915-16, No. 8, pp. 284-290.

Production

CLUTE, R. L. **Practical lessons in tropical agriculture: Book II.** x and 258 pp.; diagrs., ills., glossary, index. **Book III.** vii and 251 pp.; diagrs., ills., glossary, index. World Book Co., Yonkers, N. Y., 1916. 7½ x 5½.

These two additional books on tropical agriculture maintain the high standard set in Book I (reviewed in the April, 1916, *Review*, Vol. 1, pp. 327-328). The presentation is attractive, direct, forceful, simple, and instructive. The style is somewhat primer-like, for the volumes are intended as text-books to be used in the schools of the Philippine Islands, where the students, even though advanced, are presumably still developing their knowledge of the English language.

A noteworthy feature is the scheme employed to introduce the student to modern methods of harvesting and other types of work in the light of the antiquated native procedure, without reacting unfavorably upon the native. For example, one reads, ''Most rice in the Philippines is harvested by hand.'' This, after a few qualifying sentences is followed by, ''In some countries rice is harvested by a machine that cuts the grain and ties it into bundles.'' This is further amplified.

Book II describes the mechanics of a farm, presents a detailed account of the leading crops, and briefer statements relative to a group of miscellaneous but nevertheless important products. In Book III, among other things, crop rotation, fruits, forests, domestic animals, and business methods constitute leading topics.

These books are not only replete with information for the agricultural specialist and the layman but also for the geographer who would increase his knowledge of the Philippines in a practical way. EUGENE VAN CLEEF.

INDEX

B

C

H

I

O

W

X

Y

Z

ERRATA

p. 6, title of Fig. 5: *for* Balmadeda *read* Balmaceda.

p. 21, line 9 from bottom: *for* Jornado *read* Jornada.

p. 37, Fig. 10: *the symbol for the Manchester Ship Canal should not be the same as for the other canals, as it did not exist in 1816; its course is merely shown for comparison.*

p. 43, lines 14-15: *for* Board of Education *read* Board of Agriculture.

p. 44, line 9 from bottom: *for* steadily *read* gradually.

p. 52, table, last column, line 1: *dele* Report.

p. 84, line 18: *for* Tip. Calesiana *read* Tip. Salesiana.

Map facing p. 124: *the trifoliate area in the northwestern corner of Arizona should be colored to indicate Western Xerophytic Evergreen Forest.*

p. 140, line 22 from bottom: *for* Russion *read* Russian.

p. 146, line 18 from bottom: *for* Mjōberg *read* Mjöberg.

p. 154, line 20 from bottom: *for* flammande *read* flamande.

p. 157, line 23: *for* London *read* Hereford, England.

p. 166, ninth and tenth entries: *supply accents, etc., as follows:* dessinée, française, itinéraires, Barnabé, opérations, Crimée.

p. 246, line 7 from bottom: *for* Dr. Frank D. Adams of McGill University *read* Mr. J. Adams.

p. 339, title of Fig. 1, line 1: *for* Geographical *read* Geological.

p. 407, line 28: Stupart, Frederic, *i.e.* Stupart, R. F.

p. 411, line 14 from bottom: *for* Sellard, E. S., *read* Sellards, E. H.

Additional Errata to Vol. II

p. 232, line 23 from bottom: *for* 1846 *read* 1821.

p. 387, line 7: *for* No. 9 *read* No. 15.

p. 471, line 15 of second item: *for* North Star Bay *read* Parker Snow Bay.